U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-282 114

WARP: A Model for Regional Documentation of Operational and Exercise Runs

Mitre Corp, Bedford, Mass

Prepared for

Environmental Protection Agency, Washington, D C

Apr 76

PB 282 114

WRAP

A Model for Regional

Documentation of Operational and Exercise Runs

This report (SW-164c) describes work performed for the Office of Solid Waste under contract no. 68-01-2976 and is reproduced as received from the contractor. The findings should be attributed to the contractor and not to the Office of Solid Waste.

U.S. ENVIRONMENTAL PROTECTION AGENCY

1978

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

BIBLIOGRAPHIC DATA SHEET

1. Report No. EPA/530/SW-164C

2.

3. Recipient's Accession No.

4. Title and Subtitle
WRAP, A Model for Regional Solid Waste Management Planning: Documentation of Operational and Exercise Runs

5. Report Date
April, 1976

6.

7. Author(s)
Edward B. Berman

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

The Mitre Corporation
Bedford, Massachusetts

10. Project/Task/Work Unit No.

11. Contract/Grant No.
68-01-2976

12. Sponsoring Organization Name and Address
Office of Solid Waste
U. S. Environmental Protection Agency
401 M St. SW
Washington, DC 20460

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstracts

WRAP, the Waste Resources Allocation Program, is a model to guide decision makers in the process of planning management systems for processing, recovery, and disposal of solid wastes. The model uses a linear fixed-charge algorithm in the examination of economic considerations. This book documents the operational and exercise runs performed with the model in the course of its development. The sites selected for examination in the runs were the St. Louis metropolitan area and Northeastern Massachusetts. Documentation of the model itself is available from the EPA, Office of Solid Waste.

17. Key Words and Document Analysis. 17a. Descriptors

Solid waste
Models, modeling
Algorithms
Fixed-charge problem
Regional planning
Facility siting

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

18. Availability Statement

19. Security Class (This Report) UNCLASSIFIED

20. Security Class (This Page) UNCLASSIFIED

21. No. of Pages 258

22. Price A12-A01

FORM NTIS-35 (REV. 3-72)

USCOMM-DC 14952-P72

ATTENTION

AS NOTED IN THE NTIS ANNOUNCEMENT, PORTIONS OF THIS REPORT ARE NOT LEGIBLE. HOWEVER, IT IS THE BEST REPRODUCTION AVAILABLE FROM THE COPY SENT TO NTIS.

This report was prepared by Edward Berman of Mitre Corp., Bedford, Massachusetts, under Contract No. 68-01-2976.

Publication does not signify that the contents necessarily reflect the views and policies of the U.S. Environmental Protection Agency, nor does mention of commercial products constitute endorsement by the U.S. Government.

An environmental protection publication (SW-164c) in the solid waste management series.

ABSTRACT

Inputs, outputs, costs and flow assumptions are presented for the St. Louis operational test program and Northeastern Massachusetts parametric exercise program of WRAP. Graphical presentation of the results of all runs is included together with an analytical cross-evaluation.

Acknowledgements

The assistance of the following people is gratefully acknowledged: Eugene A. Counihan of MITRE in the preparation of process cost estimates; Miss Deborah W. Rossino of the East-West Gateway Coordinating Council in the preparation of data for the St. Louis operational runs; Chris G. Ganotis, Frank R. Parsons, René Rofé, and Mrs. Elizabeth C. Williams of MITRE in the preparation of data for the Massachusetts exercise runs; Mrs. Verniece Hensey, David H. Lehman, and Miss Mary V. Mollo-Christensen of MITRE for the implementation of the WRAP computer program; Mrs. Elizabeth C. Williams for editorial review of the document; Dr. William M. Stein of MITRE in the development of the equation structure; Miss Donna M. Krabbe of the Environmental Protection Agency and Stephen G. Lewis of MITRE for their general guidance and counsel; and Miss Donna G. Temple for her dedication in drafting and redrafting the document. The author alone is responsible for errors or omissions.

TABLE OF CONTENTS

		Page
List of Illustrations		vii
CHAPTER 1	INTRODUCTION	1
CHAPTER 2	SUMMARY OF OPERATIONAL TEST AND EXERCISE PROGRAM RUNS	5
	The St. Louis Operational Test	5
	The Run Set	7
	Cross-Analysis of Solution Structure for the Static St. Louis Runs	11
	Run A	11
	Run A-1	20
	Run B	23
	Run B-1	26
	Run C	29
	Run E	32
	Run F	35
	Run F-1	38
	Cross-Analysis of Costs for the Static St. Louis Runs	41
	The Dynamic Run	41
	Cross-Period Structural Analysis of the Dynamic St. Louis Run	44
	The Massachusetts Exercise Program	51
	Analysis	56
	Cross-Analysis of Solution Structures for the Massachusetts Exercise Program	63
	The Base Case	63
	Run A	63
	Run A-2	66
	Run A-3	69
	Run A-4	72
	The Tonnage Parameterization	75
	Run B-1	75
	Run B-2	78
	The CROW-FLY (Region Size) Parameterization	81
	Run C-1: 45 mph speed (small region)	81
	Run C-2: 20 mph speed (medium region)	84
	Run C-3: 10 mph speed (large region)	87
	The Truck Constraint Parameterization	90
	Run D-1 (Medium Truck Constraint)	90
	Run D-2 (Tight Truck Constraint)	93
	Intercept Parameterization	96

TABLE OF CONTENTS (Concluded)

Page

CHAPTER 3 INPUTS AND ASSUMPTIONS FOR THE OPERATIONAL TEST AND EXERCISE RUNS 101

- Source Data 101
- Site Data 101
- Process Data 108
  - Process Cost Notes 108
    - Process 901, Transfer, Packer to Van 108
    - Process 902, Transfer, Packer to Container 108
    - Process 903, Transfer, Packer or Van to Rail 111
    - Process 905, Shredded Fuel Process 111
    - Process 906, Secondary Recovery 111
    - Process 907, Sanitary Landfill 111
    - Process 915, RESCO Process 112
    - Process 917, RESCO Landfill 112
    - Process 925, Dried Shredded Fuel 112
    - Process 935, Gas Pyrolysis 112
    - Process 936, Dummy Incinerator Residue 112
    - Process 946, Dummy Heavy End 116
    - Process 955, Shredded Fuel/Secondary Recovery Composite 116
- Revenues 116
- Constraints 116
  - St. Louis A, B, and B-1 116
  - St. Louis A-1, C, and E 117
  - St. Louis F 117
  - St. Louis F-1 117
  - St. Louis G 117
  - N. E. Massachusetts 117
- Transportation Data 118
- Miscellaneous Assumptions 118

CHAPTER 4 PROCESS OPTIONS AND SELECTIONS FOR THE OPERATIONAL TEST AND EXERCISE PROGRAMS 143

CHAPTER 5 OUTPUTS OF OPERATIONAL TEST AND EXERCISE PROGRAM RUNS 165

LIST OF ILLUSTRATIONS

Figure Number		Page
1	The St. Louis Region	6
2	District Centroid Locations and Tonnage Generation Assumptions for the Static St. Louis Runs	8
3	Districts, Centroid Locations and Tonnage Generation Assumptions for the Dynamic St. Louis Run	9
4	The St. Louis Run Set	10
5	Summary of Static St. Louis Runs	12
6	Sites and Site Locations for the Static St. Louis Runs	13
7	Process Options/St. Louis For Static Runs	14
8	St. Louis A-1: Off-Site Processing (Rail-Haul of Fuel)	15
9	St. Louis B: Landfill Added (Truck-Haul of Fuel) and B-1, Landfill Added (Rail-Haul of Fuel)	16
10	St. Louis F-1: Processing Forced On Utility Sites (Meramec Capacity: 1267)	17
11	Sites and Site Locations for the Dynamic St. Louis Run	42
12	Process Options/St. Louis for Dynamic Run	43
13	St. Louis G: Dynamic Run, Gas Pyrolysis in 2nd Period	45
14	Districts, Centroid Locations and Tonnage Generation Assumptions for the Massachusetts Exercise Program	52
15	Sites and Site Locations for the Massachusetts Exercise Program	57
16	Process Alternatives -- Massachusetts Exercise Program	58
17	Summary of Massachusetts Exercise Program	59
18	N. E. Mass. A: The Base Case (All Options)	60
19	N. E. Mass. C-1: CROW-FLY at 45 M.P.H.	61
20	N. E. Mass. D-2: Tight Truck Constraints	62
21	St. Louis A: The Base Case (Truck-Haul of Fuel)	144
22	St. Louis A-1: Off-Site Processing (Rail-Haul of Fuel)	145
23	St. Louis B: Landfill Added (Truck-Haul of Fuel) and B-1, Landfill Added (Rail-Haul of Fuel)	146
24	St. Louis C: No Interstate Flows (Rail-Haul of Fuel)	147
25	St. Louis E: Half Commercial Tonnage (Rail-Haul of Fuel)	148
26	St. Louis F: Processing Forced on Utility Sites (Meramec Capacity: 624)	149

LIST OF ILLUSTRATIONS (concluded)

Figure Number — Page

27 St. Louis F-1: Processing Forced on Utility Sites 150
28 St. Louis G: Dynamic Run, Gas Pyrolysis 151
29 N. E. Mass. A: The Base Case (All Options) 152
30 N. E. Mass. A-2: Base Case 153
31 N. E. Mass. A-3: Base Case with all 514 Starting Basis 154
32 N. E. Mass. A-4: Base Case with all-Haverhill Starting Basis 155
33 N. E. Mass. B-1: Double Tonnage 156
34 N. E. Mass. B-2: Half-Tonnage 157
35 N. E. Mass. C-1: CROW-FLY at 45 M.P.H. 158
36 N. E. Mass. C-2: CROW-FLY at 20 M.P.H. 159
37 N. E. Mass. C-3: CROW-FLY at 10 M.P.H. 160
38 N. E. Mass. D-1: Moderate Truck Constraints 161
39 N. E. Mass. D-2: Tight Truck Constraints 162
40 N. E. Mass. E-1: Double Intercepts 163
41 N. E. Mass. E-2: Half Intercepts 164

Table Number — Page

I District Centroid Locations and Tonnage Generation Assumptions for the Static St. Louis Runs 102
II Districts, Centroid Locations and Tonnage Generation Assumptions for the Dynamic St. Louis Runs 103
III Districts, Centroid Locations and Tonnage Generation Assumptions for the Massachusetts Exercise Program 104
IV Sites and Site Locations for the Static St. Louis Runs 105
V Sites and Site Locations for the Dynamic St. Louis Run 106
VI Sites and Site Locations for the Massachusetts Exercise Program 107
VII General Process Information 109
VIII Process Costs for the Operational Test and Exercise Programs 110
IX Recovered Materials, Compositions and Values 113
X Haul Assumptions for Recovered Materials in St. Louis Runs 114
XI Revenue Assumptions for Operational Test and Exercise Runs 115
XII Transportation File, St. Louis A 119
XIII Transportation File, St. Louis A-1 and E 122
XIV Transportation File, St. Louis B and B-1 124
XV Transportation File, St. Louis C 129

LIST OF ILLUSTRATIONS (Continued)

Table Number		Page
XVI	Transportation File, St. Louis F	131
XVII	Transportation File, St. Louis F-1	134
XVIII	Transportation File for St. Louis G	136
XIX	Transportation File for N. E. Massachusetts A	137
XX	Transportation File for N. E. Massachusetts Runs Except A	140
XXI	Outputs for St. Louis A (Phase 3 Solution)	166
XXII	Outputs for St. Louis A-1 (Phase 4 Solution)	170
XXIII	Outputs for St. Louis B and St. Louis B-1 (Phase 3 Solutions)	174
XXIV	Outputs for St. Louis C (Phase 3 Solution)	179
XXV	Outputs for St. Louis E (Phase 4 Solution)	183
XXVI	Outputs for St. Louis F (Phase 3 Solution)	187
XXVII	Outputs for St. Louis F-1 (Phase 4 Solution)	191
XXVIII	Outputs for St. Louis G (Dynamic)(Phase 3 Solution)	194
XXIX	Outputs for N. E. Massachusetts A (Phase 3 Solution)	207
XXX	Outputs for N. E. Massachusetts A-2 (Phase 4 Solution)	211
XXXI	Outputs for N. E. Massachusetts A-3 (Phase 3 Solution)	215
XXXII	Outputs for N. E. Massachusetts A-4 (Phase 3 Solution)	219
XXXIII	Outputs for N. E. Massachusetts B-1 (Phase 4 Solution)	221
XXXIV	Outputs for N. E. Massachusetts B-2 (Phase 4 Solution)	223
XXXV	Outputs for N. E. Massachusetts C-1 (Phase 4 Solution)	225
XXXVI	Outputs for N. E. Massachusetts C-2 (Phase 4 Solution)	227
XXXVII	Outputs for N. E. Massachusetts C-3 (Phase 4 Solution)	229
XXXVIII	Outputs for N. E. Massachusetts D-1 (Phase 3 Solution)	231
XXXIX	Outputs for N. E. Massachusetts D-2 (Phase 3 Solution)	233
XL	Outputs for N. E. Massachusetts E-1 (Phase 4 Solution)	235
XLI	Outputs for N. E. Massachusetts E-2 (Phase 4 Solution)	237
XLII	CROW-FLY Mode 2 Test (Front-End Only)	239

LIST OF ILLUSTRATIONS (Continued)

Map Number		Page
1	Flows to Initial Offload Point: The St. Louis Region, Run A	18
2	Flows from Initial Offload Point: The St. Louis Region, Run A	19
3	Flows to Initial Offload Point: The St. Louis Region, Run A-1	21
4	Flows from Initial Offload Point: The St. Louis Region, Run A-1	22
5	Flows to Initial Offload Point: The St. Louis Region, Run B	24
6	Flows from Initial Offload Point: The St. Louis Region, Run B	25
7	Flows to Initial Offload Point: The St. Louis Region, Run B-1	27
8	Flows from Initial Offload Point: The St. Louis Region, Run B-1	28
9	Flows to Initial Offload Point: The St. Louis Region, Run C	30
10	Flows from Initial Offload Point: The St. Louis Region, Run C	31
11	Flows to Initial Offload Point: The St. Louis Region, Run E	33
12	Flows from Initial Offload Point: The St. Louis Region, Run E	34
13	Flows to Initial Offload Point: The St. Louis Region, Run F	36
14	Flows from Initial Offload Point: The St. Louis Region, Run F	37
15	Flows to Initial Offload Point: The St. Louis Region, Run F-1	39
16	Flows from Initial Offload Point: The St. Louis Region, Run F-1	40
17	Flows to Initial Offload Point: The St. Louis Region, Run G-1st Period	46
18	Flows from Initial Offload Point: The St. Louis Region, Run G-1st Period	47
19	Flows to Initial Offload Point: The St. Louis Region, Run G-2nd Period	48
20	Flows from Initial Offload Point: The St. Louis Region, Run G-2nd Period	49
21	Flows to Initial Offload Point: The St. Louis Region, Run G-3rd Period	50
22	Flows from Initial Offload Point: The St. Louis Region, Run G-3rd Period	53

LIST OF ILLUSTRATIONS (Continued)

Map Number		Page
23	Flows to Initial Offload Point: The St. Louis Region, Run G-4th Period	54
24	Flows from Initial Offload Point: The St. Louis Region, Run G-4th Period	55
25	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run A	64
26	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run A	65
27	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run A-2	67
28	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run A-2	68
29	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run A-3	70
30	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run A-3	71
31	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run A-4	73
32	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run A-4	74
33	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run B-1	76
34	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run B-1	77
35	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run B-2	79
36	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run B-2	80
37	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run C-1	82
38	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run C-1	83
39	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run C-2	85
40	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run C-2	86
41	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run C-3	88
42	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run C-3	89
43	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run D-1	91
44	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run D-1	92

LIST OF ILLUSTRATIONS (Concluded)

Map Number		Page
45	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run D-2	94
46	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run D-2	95
47	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run E-1	97
48	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run E-1	98
49	Flows to Initial Offload Point: The Northeastern Massachusetts Region, Run E-2	99
50	Flows from Initial Offload Point: The Northeastern Massachusetts Region, Run E-2	100

CHAPTER 1

INTRODUCTION

What to do with the millions of tons of solid waste produced annually throughout the country creates difficult decisions that must be addressed at local levels. These decisions, which were once rather straightforward, are now complicated by the increasing costs of disposal, new technologies, environmental regulations, and the unavailability of land for landfill. These factors facing local decision makers give rise to strong pressures towards the regionalization of solid waste management functions. However, regionalization itself creates two fundamental problems: the complexity of the regional system design; and a problem of political consensus among the participants.

To assist local planners with both of these problems, an optimizing model has been developed for the generation of minimum cost regional solid waste management plans. The model is a fixed-charge linear programming model, using an algorithm developed by Dr. Warren Walker[1].

The model receives as input:

- waste generation data by district (represented as occurring at a point, or centroid source within that district)
- possible sites for transfer, processing, and disposal
- possible processes at each site
- a transportation network defining source-to-site and site-to-site transit times
- process costs (fixed and variable) and flows
- transportation costs (variable costs only).

From these data, the model will generate a comprehensive regional solid waste management plan, including the selection of sites and processes, sizing each site, and determining links and flows among sources of waste generation, processing sites, and disposal sites. The generated plan will be the minimum cost way of handling all of the wastes while meeting all environmental, tonnage, and traffic constraints.

By using the model, decision makers can find answers to such questions as: Which technology should be selected? Where should the facility and subscribing transfer stations be located? Whom should they serve? How large should they be? What will a system that meets all the objectives cost? What are good alternatives and what will they cost? In sum, what is the most economically preferred regional system design and what are the costs associated with changing that design?

---

[1] Warren E. Walker, Adjacent Extreme Point Algorithms for the Fixed Charge Problem, Dept. of Operations Research, College of Engineering, Cornell University, January 30, 1968.

A key capability of the model is its ability to balance the economies of scale achievable through centralization of processing at one location against the additional haul costs required for centralization. This makes it possible to determine what levels of centralization make the most economic sense.

The model consists of a series of equations which consider the sources of solid waste generation over a given planning region, a set of sites, and processes to be considered at those sites, as well as various site and process capacity constraints and traffic constraints. The processes can be transfer stations, resource recovery processes (including the extraction of recoverable resources to be marketed), secondary processes (which receive the residue of primary processes as input) and various disposal processes. The model further considers many transportation route alternatives from sources of waste generation to sites, and from sites to sites.

Processing costs are input to the model so as to reflect the economies of scale available for each process, and revenues from the marketing of recovered materials. Haul costs are included, which increase directly which both tonnage and travel time.

The model has three essential components:

structure - which assures that each alternative considered is feasible in the sense that all wastes generated are entered into transportation, that all wastes arriving at a site are processed, that all residues generated are processed at the site or entered into transportation, that no process exceeds the indicated tonnage maximums) and that traffic constraints are observed,

cost - which assures that each alternative is properly costed, including economies of scale where appropriate, and

procedure - an organized mathematical procedure which allows those options which improve the solution to be separated from those that make it worse, and indicates when the procedure has identified the least cost solution.

The model was originally designed in eighteen alternative modes of operation (nine static modes and nine dynamic modes) under a MITRE-sponsored research project[2]. In 1974, a basic static mode of the model was used for a program of operational runs in support of regional design analysis for the Commonwealth of Massachusetts. This program used manually-generated inputs to the algorithm, and a manual interpretation of outputs.[3] This original model was known as SWAMP (Solid WAste Management Planning).

---

[2] This design was reported in MITRE Report M73-111, E. B. Berman, A Model for Selecting, Sizing, and Locating Regional Solid Waste Processing and Disposal Facilities, October 1973.

The Systems Management Division, Office of Solid Waste Management Programs, U. S. Environmental Protection Agency, supported the further development of the model. The EPA project included:

- The development of a computerized preprocessor and postprocessor for one static mode and one dynamic mode of the model.
- An operational test program on the Greater St. Louis Region (the City of St. Louis and seven surrounding counties).
- A parametric exercise program on a region of 53 communities of Massachusetts and New Hampshire.
- Documentation and dissemination.

The version of the model developed for EPA is known as WRAP (Waste Resources Allocation Program).

The EPA developmental program has been documented in four volumes:

- Executive Summary, includes a brief description of the model and its application programs. The focus is on the use of the model to illuminate political and technical issues. (WRAPping Up The Solid Waste Management Problem: A Model for Regional Solid Waste Management Planning, M76-207, April 1976.)
- User's Guide, is addressed to the operations research analyst. It contains a technical description of the model (Chapter 2), a guide to the preparation of inputs (Chapter 3) and a guide to the interpretation of outputs (Chapter 4). Chapter 5 contains example inputs and outputs for one static run and for one dynamic run. Chapter 6 presents the running time experience for the two run series. Chapter 7 presents a guide to the design and operation of a model application. (WRAP - A Model for Regional Solid Waste Management Planning: User's Guide, MTR-3222, April 1976.)
- Programmer's Manual, contains a full description of the program, its flowcharts and its control options. (WRAP - A Model for Regional Solid Waste Management Planning: Programmer's Manual, April 1976.)
- Documentation of Operational and Exercise Runs, presents the results of the 9 operational test runs and 13 exercise program runs. Chapter 2 presents a summary and analysis of the

---

[3] The runs were reported in E. B. Berman and H. J. Yaffe, MTR-2945, Region Design Analysis for Regional Resource Recovery System for Northeastern Massachusetts, November 1974.

operational and exercise runs. Chapter 3 describes inputs and assumptions for both run programs. Chapter 4 presents tables of processing options offered and selected for each of the 22 operational and exercise runs. Chapter 5 presents full numerical outputs of each of the 22 operational and exercise runs. (WRAP - A Model for Regional Solid Waste Management Planning: Documentation of Operational and Exercise Runs, MTR-3219, April 1976.)

This volume comprises the documentation of operational and exercise runs. The other volumes may be obtained by calling or writing:

The Systems Management Division
Office of Solid Waste Management Programs
Environmental Protection Agency
401 M Street
Washington, D.C. 20460
Telephone: (202) 755-9125.

CHAPTER 2

SUMMARY OF OPERATIONAL TEST AND EXERCISE PROGRAM RUNS

This chapter presents a narrative and graphical description of the St. Louis operational test runs and N.E. Massachusetts exercise program runs. A complete set of inputs and assumptions for these runs is presented in Chapter 3 and a complete numerical description of the outputs of these runs is presented in Chapter 5.

A pair of maps has been prepared for each run, and for each time period of the one dynamic run. These maps are included in this section to present a graphical description of the runs. In the pair, the first presents the flows from each centroid of waste generation to each initial offload point. The second map in the pair shows the flows from the initial offload points. The second map also identifies which sites were selected for processing, and which of these were transfer, primary processing, secondary processing and landfill sites. The second map shows transfer flows, flows from primary to secondary processing, and fuel flows from primary processing to the market (fuel flows are not shown for the N.E. Massachusetts runs, since no markets were identified for those runs).

The St. Louis Operational Test

A region of seven counties and the City of St. Louis was selected for the operational test.

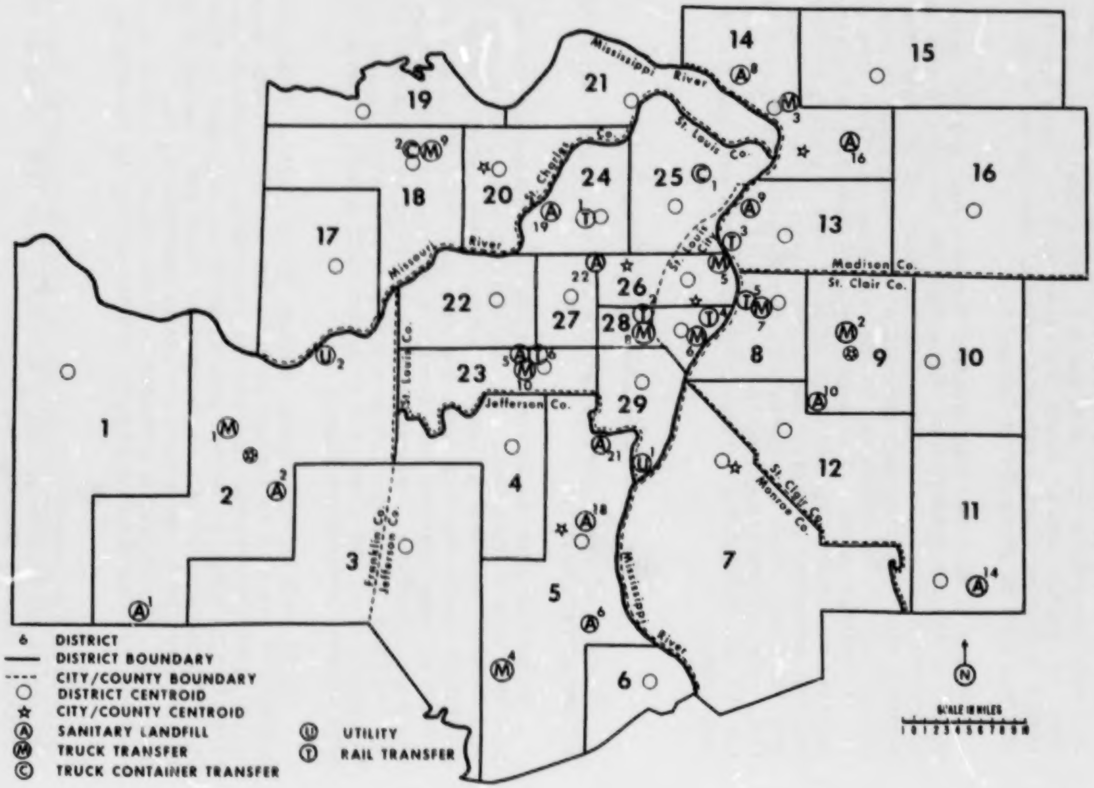
An earlier study by Sverdrup and Parcel[4] provided much of the data that were used in this test. The remainder were supplied by the East-West Gateway Coordinating Council. Waste volumes and most of the waste generation source and site locations were those identified by Sverdrup and Parcel; the remainder were identified by the East-West Gateway Coordinating Council. Centroid sources and sites are displayed on the map in Figure 1. Transportation activity one-way times between sources and sites, sites and sites, and sites and markets were estimated by East-West Gateway Coordinating Council.

The Union Electric company, through its subsidiary, Union Colliery Company, is planning to install an 8,000 ton per day resource recovery system using the shredded fuel process (shredding, air classification, magnetic separation of ferrous metals) which was developed by them. The St. Louis operational test is designed to illuminate a number of political issues suggested by the East-West Gateway Coordinating Council. It is hoped that the information provided by these runs will assist the communities, the Coordinating Council, and the utility by identifying their

---

[4] Solid Waste Management Plan for the St. Louis Metropolitan Area, Sverdrup and Parcel and Associates, Inc., St. Louis, June 1974, prepared for the East-West Gateway Coordinating Council.

Figure 1
THE ST. LOUIS REGION


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
St. Louis City
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10

common interest in working together to implement the resource recovery system.

The Run Set

The St. Louis region was divided into 29 districts for waste generation for the static runs and into 8 (seven counties and the City of St. Louis) for the dynamic run. The districts, centroid locations, and tonnage generation assumptions are displayed in Figure 2 (static) and Figure 3 (dynamic).

There were originally a total of seven runs in the set, six static and one dynamic. One of the static runs was dropped as irrelevant, and three of the static runs were performed under alternative assumptions, so that there were eight static runs as actually implemented.

Figure 4 describes the operational test run set as implemented. Run D was not run because the loss of the Illinois Power Co. market did not make any cost difference, and hence the case degenerated into the base case.

The A-1 and B-1 variants represent primarily a modification in the assumption on fuel haul. In the original runs, which included runs A and B, it was assumed that fuel which was produced at off-utility sites would be trucked to the closest utility location from each site that was chosen for processing. The model generated a solution in runs A and B in which all of the fuel was being trucked to the Meramec plant; and in fact the capacity of that plant to absorb fuel was being exceeded. Because of excess deliveries to the Meramec plant, and an excess number of trucks, the assumption was modified; all fuel was to be rail-hauled at a flat cost of $3.00 per ton of fuel, regardless of destination within the region. In runs A-1 and B-1, rail-haul of fuel was assumed. In addition, run A-1 was a stripped-down version of run A in size, and was run through phase 4[7]. Both B and B-1 were large models (112 equations and 513 activities) and were run only through phase 3 because it did not appear likely that any additional landfills would improve the solution.

In run F, processing was forced onto the utility locations, with the Meramec plant being limited to an input of 2,000 tons per day of raw refuse. After further consultation with Union Electric staff, that constraint was raised to 4,062 tons per day of raw refuse in run F-1, representing a 65% utilization of a shredded fuel capacity of 5,000 tons per day, translated back to raw refuse through a factor of 0.8 tons of fuel per ton of raw refuse. In addition run F was used as guidance to strip down the problem in size in order to obtain a phase 4 solution for F-1.

---

[7] In phase 3, a best solution is found among adjacent extreme points; in phase 4, single forcing is used (one column at a time is forced into the solution). Phase 4 requires considerable running time for a large problem, but frequently finds a better solution. The phase 3 runs were used to guide the stripping of the model for the phase 4 runs.

Figure 2
DISTRICT CENTROID LOCATIONS AND TONNAGE
GENERATION ASSUMPTIONS FOR THE STATIC ST. LOUIS RUNS*

SOURCE DISTRICT	CENTROID LOCATION LONG DEG.|MIN	 LAT DEG.|MIN	TONNAGE 000 TONS PER YEAR OTHER RUNS	 ST. LOUIS E
101 DISTRICT 1	91 15.80	38 31.80	5.9	5.1
102 DISTRICT 2	90 58.20	38 25.50	32.0	28.9
103 DISTRICT 3	90 43.00	38 18.20	4.5	4.3
104 DISTRICT 4	90 32.50	38 25.90	10.9	10.3
105 DISTRICT 5	90 25.80	38 18.40	53.3	48.5
106 DISTRICT 6	90 20.30	38 08.40	1.1	1.0
107 DISTRICT 7	90 10.80	38 22.10	14.9	14.1
108 DISTRICT 8	90 07.60	38 36.40	218.2	205.0
109 DISTRICT 9	89 59.50	38 33.40	86.9	74.9
110 DISTRICT 10	89 51.10	38 32.30	38.2	23.3
111 DISTRICT 11	89 50.10	38 15.70	13.7	12.9
112 DISTRICT 12	90 04.10	38 27.20	9.9	8.7
113 DISTRICT 13	90 05.90	38 42.50	103.5	92.0
114 DISTRICT 14	90 06.00	38 52.30	148.4	135.3
115 DISTRICT 15	89 56.90	38 55.20	16.8	15.0
116 DISTRICT 16	89 45.20	38 44.60	16.7	14.5
117 DISTRICT 17	90 50.40	38 40.00	2.3	2.1
118 DISTRICT 18	90 42.80	38 48.20	35.8	33.3
119 DISTRICT 19	90 47.90	38 52.00	1.1	1.0
120 DISTRICT 20	90 30.70	38 47.10	44.4	39.8
121 DISTRICT 21	90 20.60	38 53.70	3.7	3.5
122 DISTRICT 22	90 34.30	38 37.20	58.1	46.8
123 DISTRICT 23	90 30.50	38 31.70	46.6	38.4
124 DISTRICT 24	90 24.30	38 43.90	147.0	122.5
125 DISTRICT 25	90 16.80	38 44.70	330.9	282.1
126 DISTRICT 26	90 15.60	38 38.80	514.0	405.5
127 DISTRICT 27	90 27.10	38 37.30	67.0	[illegible]
128 DISTRICT 28	90 16.40	38 34.90	339.8	282.4
129 DISTRICT 29	90 19.50	38 31.10	128.4	109.2

---

*Source: Sverdrup & Parcel, Op. Cit., Source: p. 201.

Figure 3

DISTRICTS, CENTROID LOCATIONS AND TONNAGE GENERATION ASSUMPTIONS FOR THE DYNAMIC ST. LOUIS RUN*

DISTRICT	CENTROID LOCATION				TONNAGE 000 TONS PER YEAR			
	LONG		LAT		PERIOD			
	DEG.	MIN	DEG.	MIN	1	2	3	4
SOURCE 101 FRANKLIN COUNTY	90	58.2	38	25.5	39.1	50.8	75.9	98.80
SOURCE 102 JEFFERSON COUNTY	90	28.1	38	19.3	65.5	90.6	148.5	202.40
SOURCE 103 MADISON COUNTY	90	03.1	38	49.7	280.1	361.7	539.8	702.30
SOURCE 104 MONROE COUNTY	90	09.8	38	21.1	10.2	14.8	25.1	34.80
SOURCE 105 ST. CHARLES COUNTY	90	32.7	38	47.1	79.3	114.6	195.3	271.00
SOURCE 106 ST. CLAIR COUNTY	89	59.5	38	33.4	358.2	449.1	636.1	803.40
SOURCE 107 ST. LOUIS CITY	90	14.6	38	37.2	795.3	895.6	1070.3	1205.40
SOURCE 108 ST. LOUIS COUNTY	90	21.4	38	40.1	838.7	1075.3	1582.2	2042.20

---

*County centroids were taken from the map in Sverdrup & Parcel, Op. Cit., p. 137. Waste tonnages were estimated for the years 1978 (for period 1), 1984 (for period 2), 1993 (for period 3) and 1999 (for period 4) using interpolations of Sverdrup & Parcel projection II (Ibid, p. 53) which assumed a 2% per year growth rate in solid waste generation per capita.

Figure 4

THE ST. LOUIS RUN SET

A. BASE CASE - ALL RESOURCE RECOVERY OPTIONS ⟶ A-1 VARIANT

B. ADD LANDFILL ⟶ B-1 VARIANT

C. NO INTERSTATE FLOWS

D. LOSS OF ILLINOIS POWER CO. MARKET [NOT RUN - BECAUSE IRRELEVANT]

E. HALF COMMERCIAL TONNAGES

F. PROCESSING FORCED TO UTILITY SITE ⟶ F-1 VARIANT

G. DYNAMIC RUN

Figure 5 gives a summary of the static St. Louis runs.

Figure 6 displays the 34 site locations which were used in versions of the St. Louis static runs, and Figure 7 displays the processes.

Figures 8, 9, and 10 display the site/process/linear segment options that were offered, the options that were selected, the activity levels, the total system cost and cost per ton, for three selected runs, runs A-1, B/B-1 and F-1. The full set of options and selections is presented below in Chapter 4.

In these displays (and in those that follow for the Massachusetts Application Program) the options are the sites, processes and linear cost segments (in which 13 means 1 through 3) and the selections are the activity levels (and selected segment in parentheses). The selected process has been boxed for easier identification.

Cross-Analysis of Solution Structure for the Static St. Louis Runs

The structure of solutions for the static St. Louis runs are described graphically in maps 1-16.

Run A

Run A is the resource recovery base case with landfill offered only for residue. It was run only through phase 3. Truck haul of fuel was assumed, with each processing site linked to its closest utility. In effect, all fuel went to Meramec, so that this solution is not really feasible because it exceeds the capacity at Meramec.

The first map (map 1) shows the pattern of flows to initial offload. The second map (map 2) shows that four sites (M5, M6, M7, and M10) were chosen for primary processing and M5 was chosen as the sole site for secondary processing of the heavy end material. Landfill was offered only for heavy end, but was not chosen.

Six transfer stations were chosen at M1, M2, M3, M4, M8, and M9. All of these selected the packer-to-van transfer process, for truck transportation to one or another of the primary processing sites.

Figure 5

SUMMARY OF STATIC ST. LOUIS RUNS

RUN		LAST PHASE	FUEL HAUL	PROCESSING LOCATIONS		COST, $/TON	LANDFILL
				PRIMARY	SECONDARY		
A	BASE CASE	3	TRUCK	M5, M6, M7, M10	M5	1.253	NONE
A-1	OFF-UTILITY SITE	4	RAIL	M5, M6, M7	M5	1.44	NONE
B	LANDFILL ADDED	3	TRUCK	M5, M6, M7, M10	M5	1.249	DISTRICT 11 TO BROWN - MARISSA
B-1	LANDFILL ADDED	3	RAIL	M5, M6, M7, M10	M5	1.61	
C	NO INTERSTATE FLOWS	3	RAIL	M6, M7, M10	M6 & M7	1.84	NONE
D	LOSS OF ILLINOIS POWER	—	—	— NOT	RUN —	— —	— —
E	HALF COMMERCIAL TONNAGES	4	RAIL	M5, M7, M10	M5	1.75	NONE
F	PROCESSING FORCED ON-SITE	3	NA	U2 (LABADIE)	U2	1.95	NONE
F-1	PROCESSING FORCED ON-SITE	4	NA	U1 (MERAMEC) AND U2	U1, U2	1.59	NONE

Figure 6

SITES AND SITE LOCATIONS FOR THE STATIC ST. LOUIS RUNS

SITE	LOCATION LONG DEG.	 MIN	 LAT DEG.	 MIN	(FOR ULTIMATE SITES ONLY) ACRE-FEET AVAILABLE
501 M1 TRANS	91	01.1	38	26.8	
502 M2 TRANS	90	00.7	38	35.5	
503 M3 TRANS	90	06.9	38	53.6	
504 M4 TRANS	90	33.7	38	08.9	
505 M5 TRANS PROC	90	12.9	38	40.1	
506 M6 T4 TRANS PROC	90	16.7	38	34.9	
507 M7 T5 TRANS PROC	90	08.8	38	37.7	
508 M8 T2 TRANS	90	20.8	38	35.5	
509 M9 C2 TRANS	90	42.2	38	49.7	
510 M10 T6 TRANS PROC	90	30.6	38	30.8	
511 M11 C1 TRANS	90	14.6	38	47.9	
512 T1 TRANS	90	25.2	38	44.7	
513 T3 TRANS	90	11.1	38	42.6	
514 U1 MERAMEC MKT PROC	90	19.4	38	26.0	
515 U2 LABADIE MKT PROC	90	52.0	38	32.4	
605 M5 SECOND PROC	90	12.9	38	40.1	
606 M6 SECOND PROC	90	16.7	38	34.9	
607 M7 SECOND PROC	90	08.8	38	37.7	
610 M10 SECOND PROC	90	30.6	38	30.8	
614 U1 MERAMEC SECOND PROC	90	19.4	38	26.0	
615 U2 LABADIE SECOND PROC	90	52.0	38	32.4	
701 A1 SULLIVAN MUNICIPAL	91	08.0	38	13.5	1000
702 A2 FRANKLIN COUNTY	90	56.1	38	22.0	1000
703 A5 WEST COUNTY	90	31.6	38	31.6	800
704 A6 JEFFERSON COUNTY	90	25.8	38	12.6	400
705 A8 ALTON MUNICIPAL	90	11.3	38	55.6	500
706 A9 MAL	90	10.0	38	44.9	5000
707 A10 MODERN SANITATION	90	01.9	38	30.8	400
708 A14 BROWN MARISSA	89	47.4	38	16.1	400
709 A16 BARTON-ROXANNA	90	00.9	38	50.5	500
710 A18 ANTONIA	90	25.8	38	20.5	250
711 A19 VIGUS QUARRY	90	28.9	38	44.7	3000
712 A21 VALLEY DISPOSAL	90	24.4	38	26.3	400
713 A22 ALTON BRICK	90	24.4	38	40.0	1000

Figure 7

PROCESS OPTIONS/ST. LOUIS FOR STATIC RUNS

TRANSFER STATIONS

901 PACKER TO TRANSFER VAN
902 PACKER TO CONTAINER
903 PACKER OR VAN TO R.R. CAR

PROCESSING

905 PRIMARY

SHREDDING
AIR CLASSIFICATION
MAGNETIC SEPARATION

906 SECONDARY

BU MINES PROCESS

907 SANITARY LANDFILL

Figure 8

ST. LOUIS A-1: OFF-SITE PROCESSING (RAIL-HAUL OF FUEL) RUN SUMMARY

62 ROWS 167 COLUMNS + 3 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: 3599.88506 AVERAGE $/TON: 1.44341

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	12	37.9	(1)	507	901	23		
502	$\boxed{901}$	13	86.9	(2)		$\boxed{905}$	13	502.0	
503	$\boxed{901}$	23	165.2	(3)	607	906	12		
504	$\boxed{901}$	12	4.5	(1)	508	$\boxed{901}$	23	395.2	(3)
505	901	23			509	$\boxed{901}$	12	87.3	(2)
	$\boxed{905}$	13	1240.0	(3)	510	$\boxed{901}$	13	153.5	
605	$\boxed{906}$	12	324.2	(2)		905	13		
506	901	23			610	906	12		
	$\boxed{905}$	13	752.0	(2)	511	901	12		
606	906	12							

ACTIVE CONSTRAINTS: TRUCK CONSTRAINT, 505/605 TRUCK CONSTRAINT, 506/606

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 9

ST. LOUIS B: LANDFILL ADDED (TRUCK-HAUL OF FUEL) and B-1, LANDFILL ADDED (RAIL-HAUL OF FUEL) **RUN SUMMARIES**

112 ROWS, 512 COLUMNS + 20 SLACKS, PHASE 3 SOLUTIONS

B: OBJECTIVE VALUE:* 3115.66636 AVERAGE $/TON: 1.249266
B-1: OBJECTIVE VALUE:* 4007.72956 AVERAGE $/TON: 1.60695

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	13	37.9	(1)	511	901	13		
	903	13				902	13		
502	$\boxed{901}$	13	86.9	(2)	512	903	13		
503	$\boxed{901}$	13	165.2	(3)	513	903	13		
	903	13			514	905	13		
504	$\boxed{901}$	13	4.5	(1)	614	906	13		
	903	13			515	905	13		
505	901	13			615	906	13		
	903	13			701	907	13		
	$\boxed{905}$	13	1056.0	(3)	702	907	13		
605	$\boxed{906}$	13	322.6	(2)	703	907	13		
506	901	13			704	907	13		
	903	13			705	907	13		
	$\boxed{905}$	13	725.4	(2)	706	907	13		
606	906	13			707	907	13		
507	901	13			708	$\boxed{907}$	13	12.1	(1)
	903	13			709	907	13		
	$\boxed{905}$	13	480.0	(2)	710	907	13		
607	906	13			711	907	13		
508	$\boxed{901}$	13	258.2	(3)	712	907	13		
	903	13			713	907	13		
509	901	13	87.3	(2)					
	902	13							
510	901	13							
	903	13							
	$\boxed{905}$	13	220.5						
610	906	13							

ACTIVE CONSTRAINTS: TRUCK CONSTRAINT, 505/606 TRUCK CONSTRAINT, 506/606

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 10

ST. LOUIS F-1: PROCESSING FORCED ON UTILITY SITES (MERAMEC CAPACITY: 1267) RUN SUMMARY

75 ROWS 181 COLUMNS + 4 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: 3955.0481 AVERAGE $/TON: 1.5858

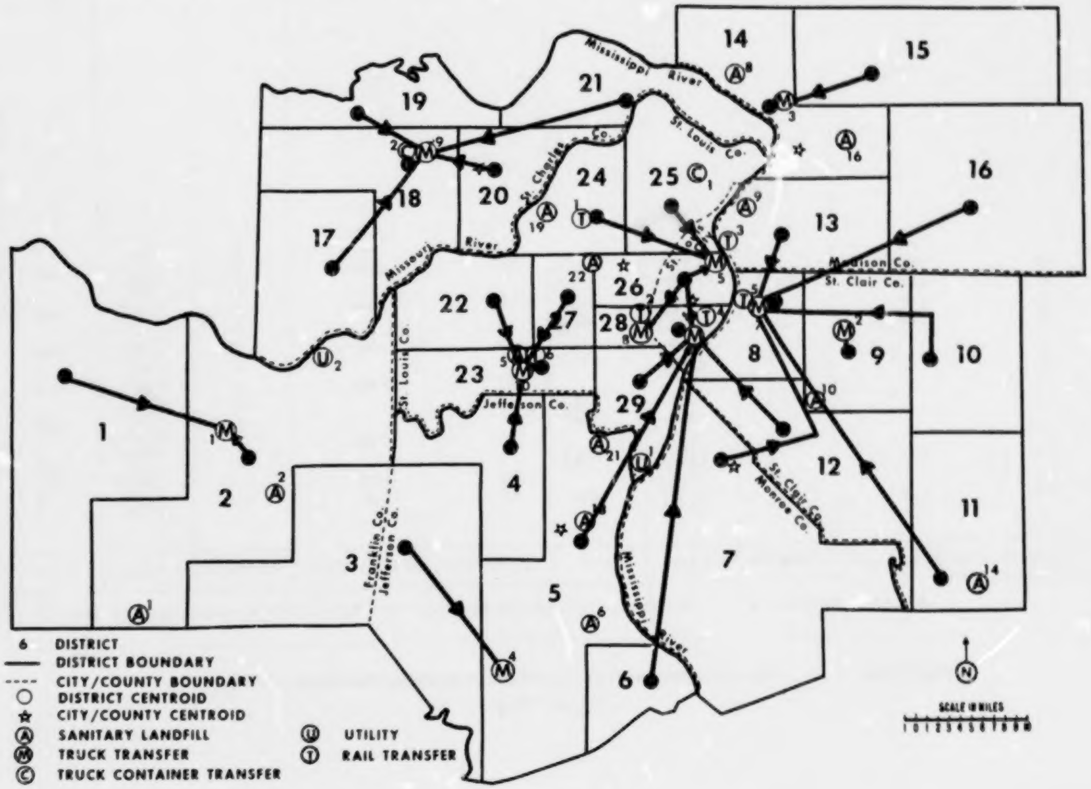
SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	12	37.9	(1)	509	$\boxed{901}$	12	36.9	(1)
502	$\boxed{901}$	13	86.9	(2)		902	12		
503	901	23			510	$\boxed{901}$	13	57.5	(2)
	$\boxed{903}$	23	165.2	(3)		903	13		
504	901	12			610	906	12		
	$\boxed{903}$	12			511	901	12		
505	$\boxed{901}$	23	434.4	(3)		902	12		
	903	23			512	$\boxed{903}$	13	262.1	(3)
506	$\boxed{901}$	23	349.7	(3)	513	903	13		
	903	23			514	$\boxed{905}$	13	1267.0	(3)
507	$\boxed{901}$	23	286.8	(3)	614	$\boxed{906}$	12	164.7	(2)
	903	23			515	$\boxed{905}$	13	1227.0	(3)
508	$\boxed{901}$	23	642.4	(3)	615	$\boxed{906}$	12	159.5	(2)
	903	23							

ACTIVE CONSTRAINT: TONNAGE CONSTRAINT AT 514 (MERAMEC PLANT)

*OBJECTIVE VALUE THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS AND CAPACITY IN THOUSANDS OF TONS PER YEAR

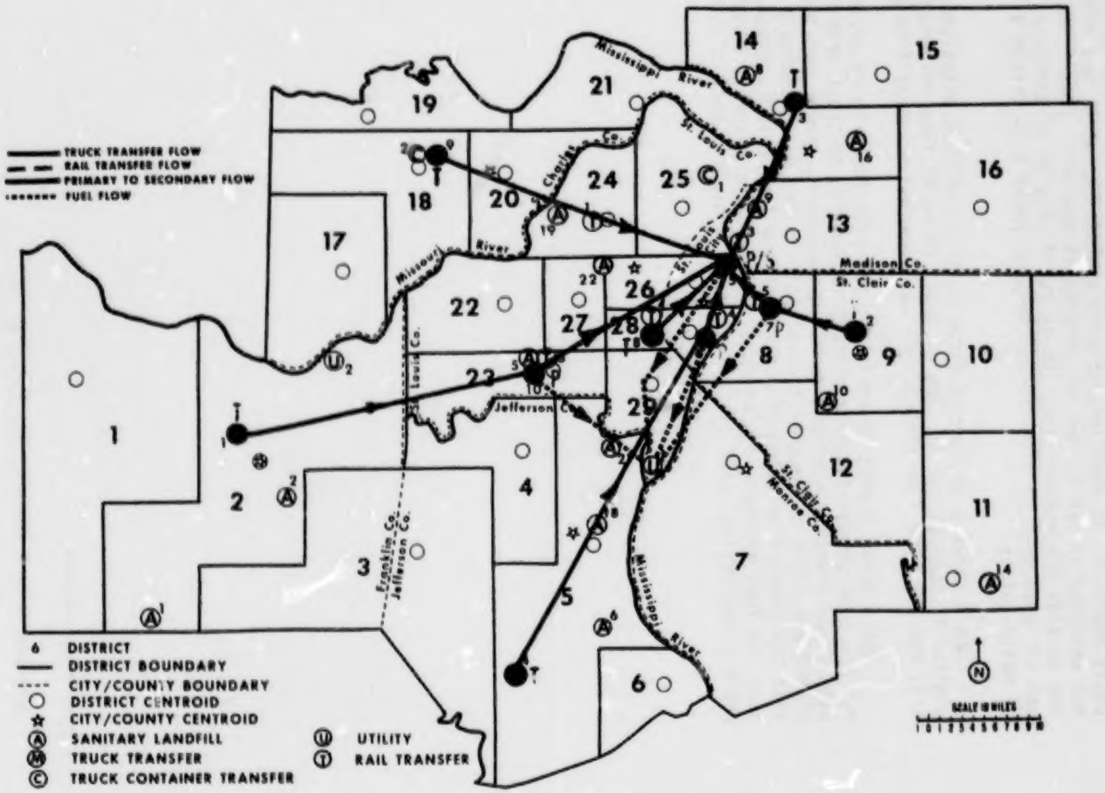
Map 1

FLOWS TO INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN A


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
Mississippi River
Missouri River
St. Louis Co.
St. Charles Co.
Jefferson Co.
Franklin Co.
Madison Co.
St. Clair Co.
Monroe Co.
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER

Map 2

FLOWS FROM INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN A


TRUCK TRANSFER FLOW
RAIL TRANSFER FLOW
PRIMARY TO SECONDARY FLOW
FUEL FLOW
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
P/S
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
N
SCALE IN MILES

Run A-1

Run A-1 is a modified resource recovery base case, with landfill offered only for residue. It differs from Run A in its fuel haul assumption; in run A-1, fuel is rail-hauled to either utility as needed. The cost of rail-haul, with relatively high costs of loading and unloading, was assumed to be invariant to distance within the limits of the St. Louis region.[8] In addition, on-site processing, which was offered but not selected in Run A, was not offered in Run A-1. Runs F and F-1 cover the on-site processing case. Using run A results as guidance, run A-1 was stripped down in size and run through phase 4 to obtain a higher level of optimization.

Map 3 shows a pattern of flows to first offload point which is quite similar to that of run A. The district 26 to M5 flow was dropped in run A-1; and the flow from district 27 was diverted entirely from M10 to M8.

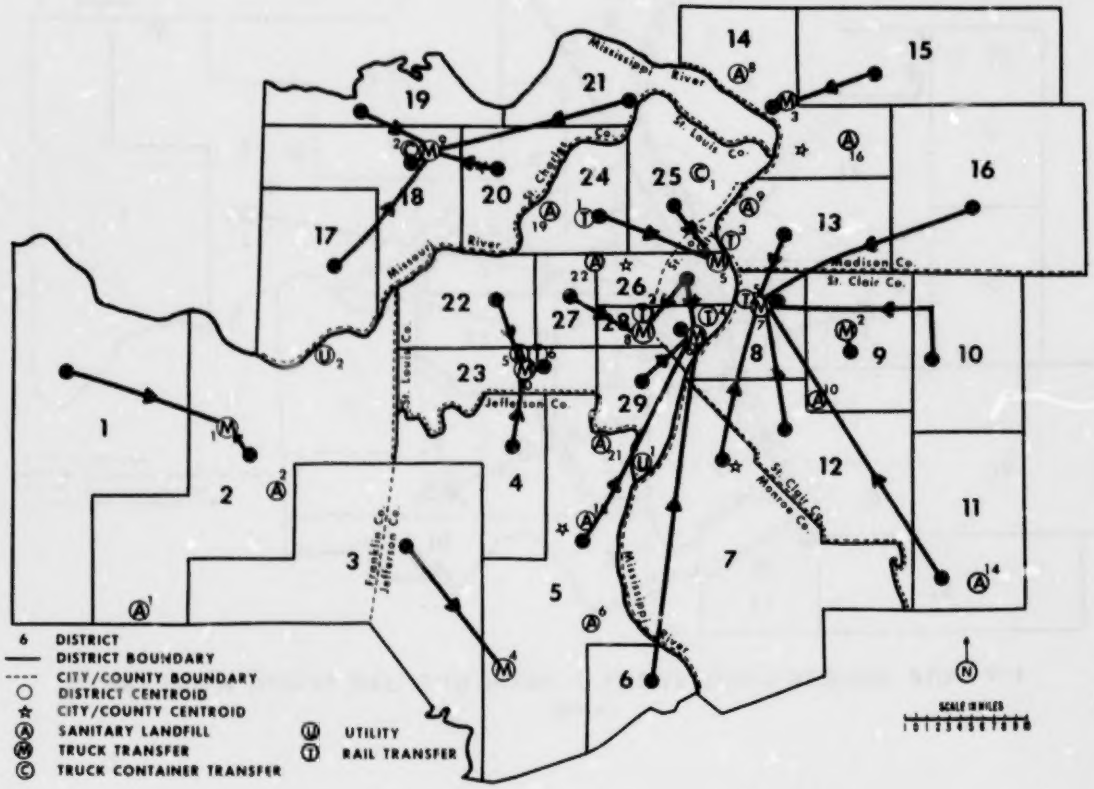
Map 4 shows a more concentrated solution for primary processing. M10 has been downgraded from primary processing to truck transfer. The pattern of transfer stations remained unchanged, except for the addition of M10 providing a transfer flow to both M5 and M6. It should be noted that the phase 3 solution of run A-1 showed four primary processing centers, so that the more concentrated solution was directly a result of the phase 4 processing, with its push towards a higher level of optimization.

---

[8] See Sverdrup & Parcel, Op. Cit., p. 207.

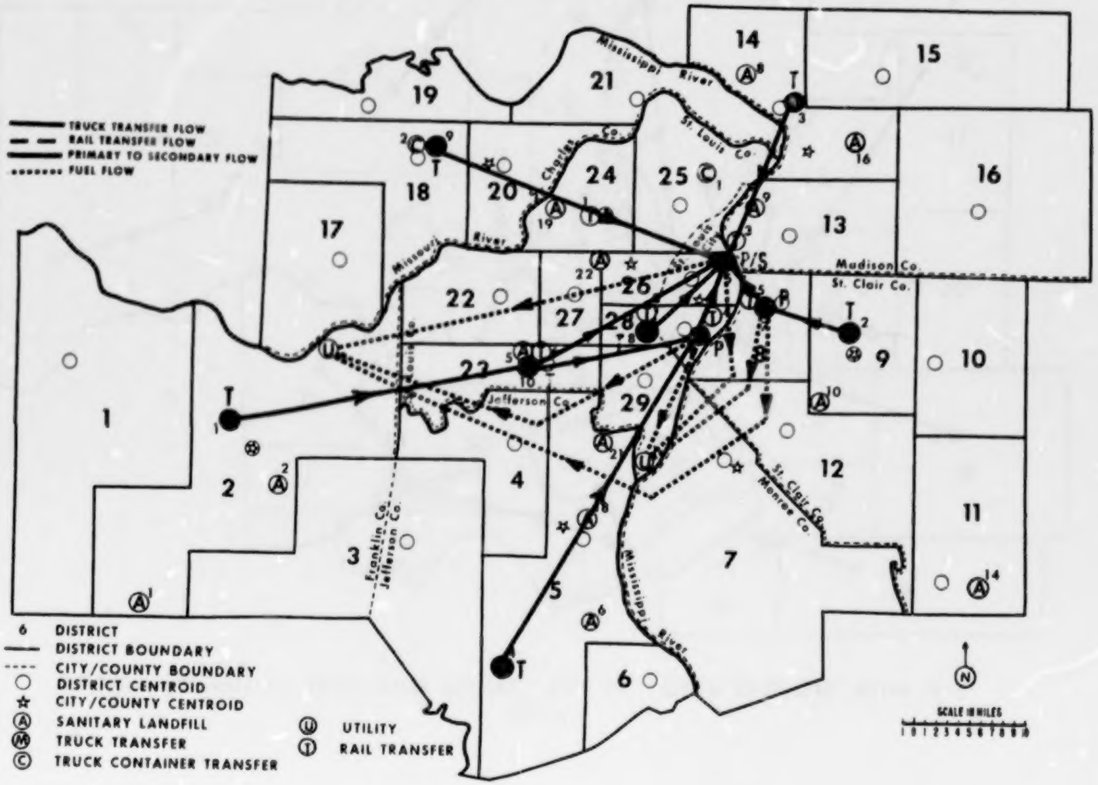
Map 3

FLOWS TO INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN A-1


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
Mississippi River
Missouri River
St. Louis Co.
St. Charles Co.
Jefferson Co.
Franklin Co.
Madison Co.
St. Clair Co.
Monroe Co.
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10

Map 4

FLOWS FROM INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN A-1


TRUCK TRANSFER FLOW
RAIL TRANSFER FLOW
PRIMARY TO SECONDARY FLOW
FUEL FLOW
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10
N
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
P/S
T
P
1
2
3
4
5
6
7
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29

Run B

Run B is the resource recovery base case modified to make landfill available for either raw refuse or residue. As in run A, truck haul of fuel was assumed, with each processing site linked to its closest utility. In effect, all fuel went to Meramec, so that this solution is also not really feasible. It represents a phase 3 solution.

Map 5 shows the pattern of flows to initial offload to be similar to those of run A, except that part of the flow from district 11 has been diverted to a landfill, Brown-Marissa (A-14).

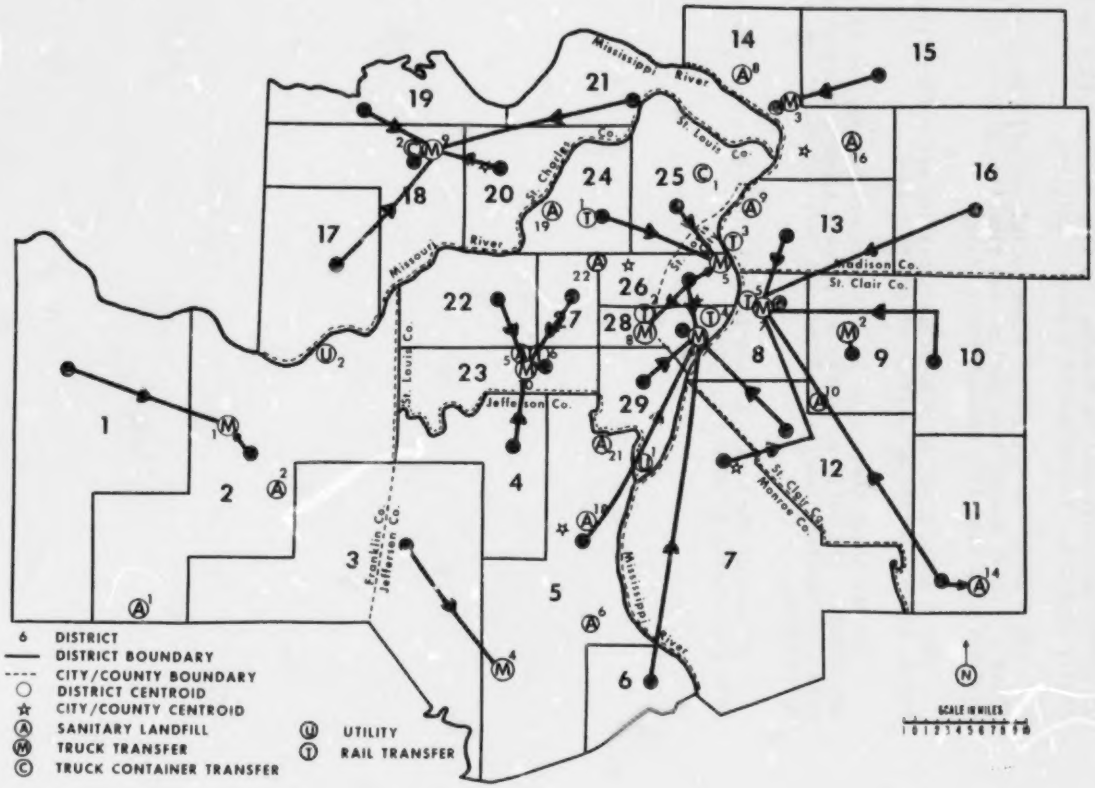
Map 6 shows a set of site activations and waste flows identical to run A, except for the activation of landfill A-14.

The run shows that, when landfill was offered for raw refuse, little was chosen. The basic shredded fuel process appears to be able to compete with sanitary landfill for the vast bulk (99.5%) of the region's solid waste.

The use of the Brown-Marissa landfill lowered the system cost by only four-tenths of a cent per ton.

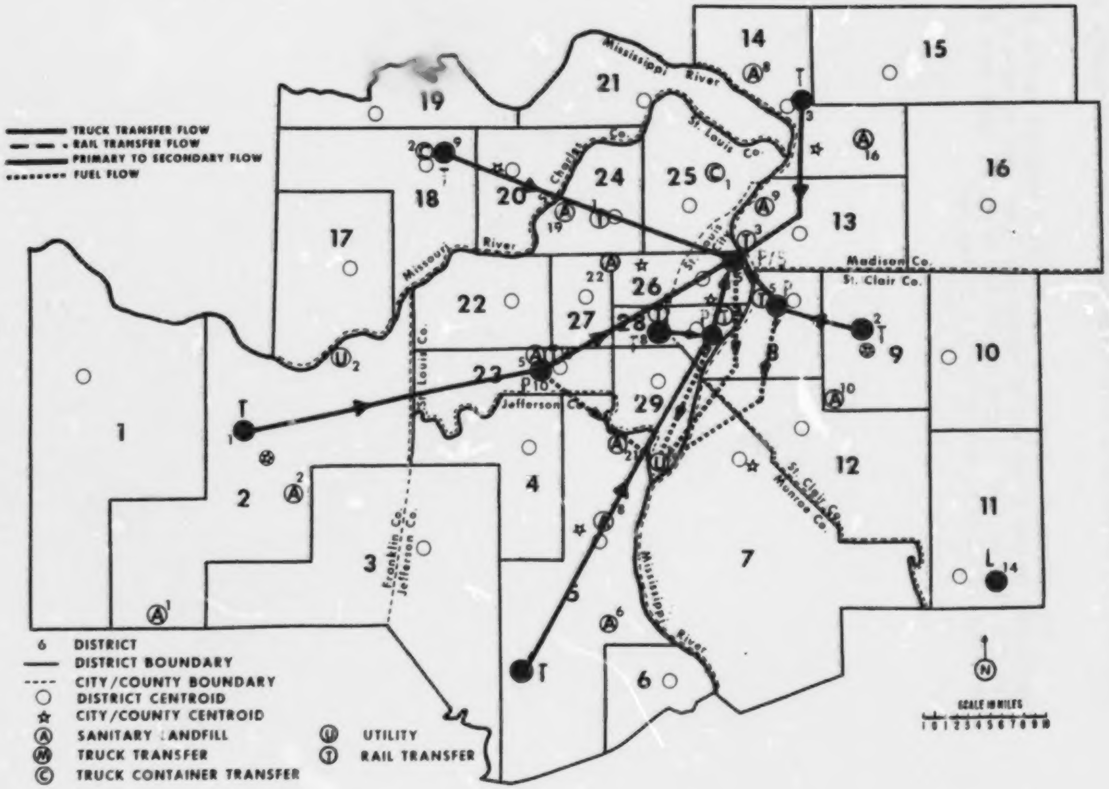
Map 5

FLOWS TO INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN B


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
Mississippi River
Missouri River
St. Louis Co.
St. Charles Co.
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10

Map 6

FLOWS FROM INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN B


TRUCK TRANSFER FLOW
RAIL TRANSFER FLOW
PRIMARY TO SECONDARY FLOW
FUEL FLOW
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10
N
Mississippi River
Missouri River
St. Louis Co.
St. Charles Co.
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
P/S

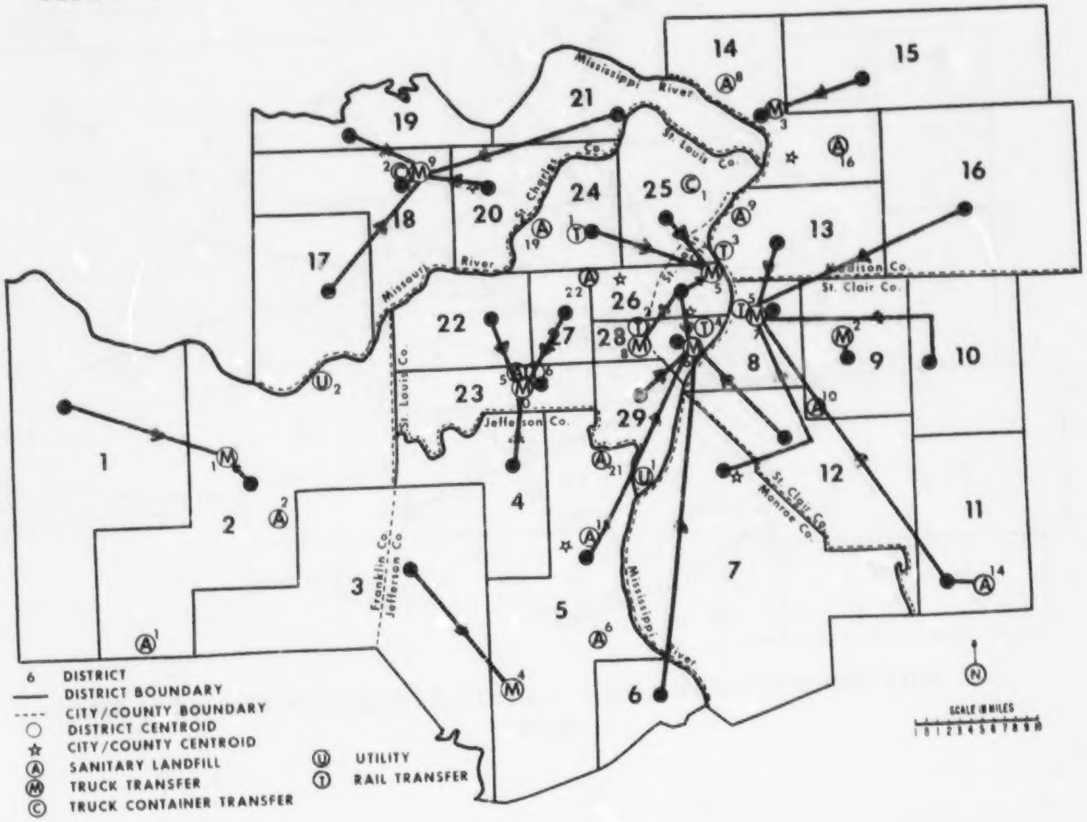
Run B-1

Run B-1 is a version of run B, modified to provide rail haul of fuel from primary processing to the utilities. As in run B, landfill is available for both raw refuse and heavy end residue, but was chosen only at A-14, Brown-Marissa, to provide part of the requirements of District 11.

The numerical solution of run B-1 is identical to run B. This is reflected in map 7 and map 8, which are identical to maps 5 and 6 except for the flow of fuel to both utilities in map 8, (and that flow represents an input assumption, not an output of the run).

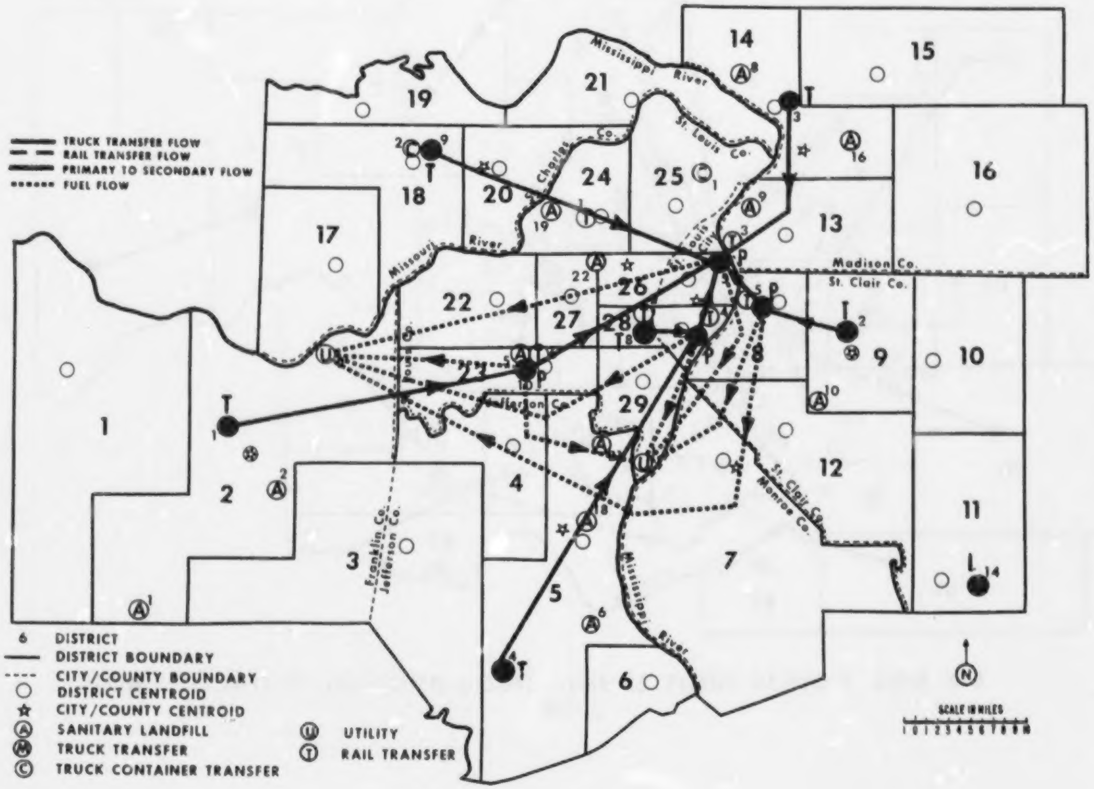
Map 7

FLOWS TO INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN B-1


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
Mississippi River
Missouri River
St. Louis Co.
St. Charles Co.
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER

Map 8

FLOWS FROM INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN B-1


TRUCK TRANSFER FLOW
RAIL TRANSFER FLOW
PRIMARY TO SECONDARY FLOW
FUEL FLOW
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
SCALE IN MILES
N
Mississippi River
Missouri River
St. Louis Co.
Charles Co.
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
24
25
26
27
28
29

Run C

Run C represents the case of no interstate flows of waste, so that the region is in effect divided into two, a Missouri portion and an Illinois portion.

The most notable result of blocking interstate flows proved to be a relocation of primary processing from site M5 in run A-1 to site M10 in run C. This appears to have resulted from a shift in the center of gravity of the Missouri subregion towards the west.

Secondary processing, which was located at M5 in run A-1, was established at M6, for the Missouri subregion, and at M7 for the Illinois subregion.

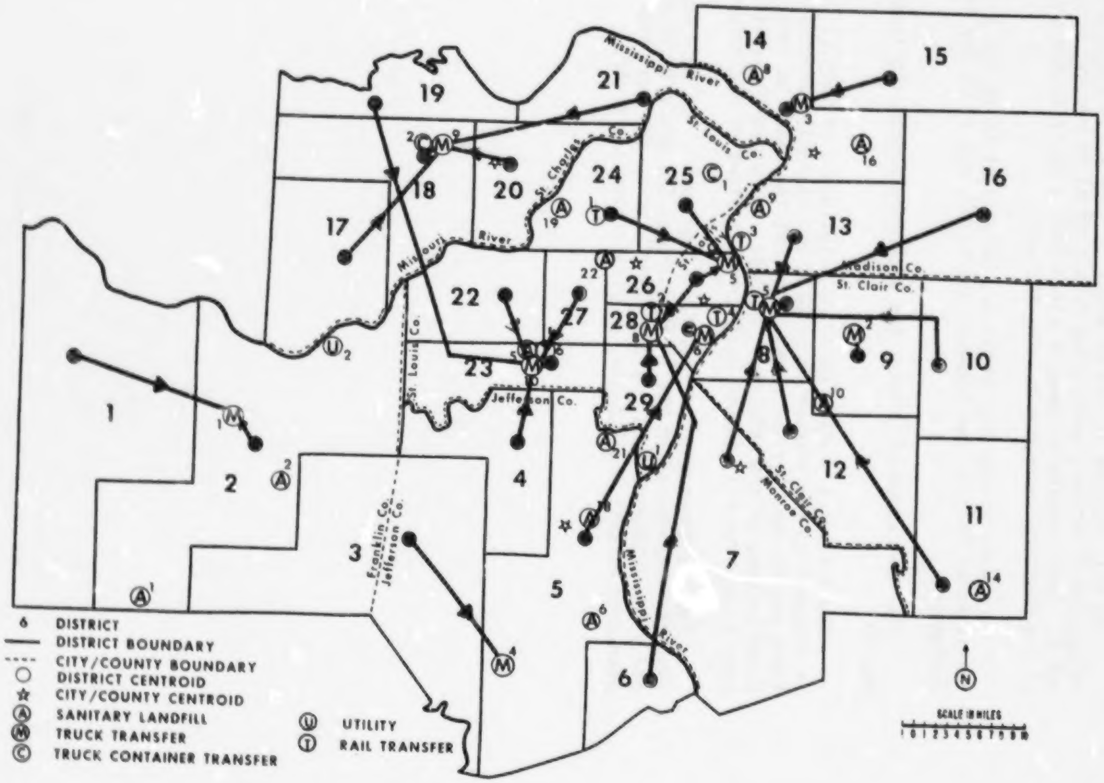
The relocation of primary and secondary processing is displayed on map 10.

Map 9 shows a pattern of minor adjustments of initial offload points in response to the changes in primary and secondary processing locations. There was no need for the model to adjust the flows to initial offload point because of the constraint against interstate flows since the base case (i.e., run A-1) showed no interstate flows of raw refuse.

Fuel is assumed to be rail-hauled in run C. In this run only, fuel from M7 is delivered to the Illinois Power Co. plant in Baldwin, Ill., and other primary processing plants deliver to the two Union Electric Co. plants at Meramec and Labadie, as illustrated in map 10.

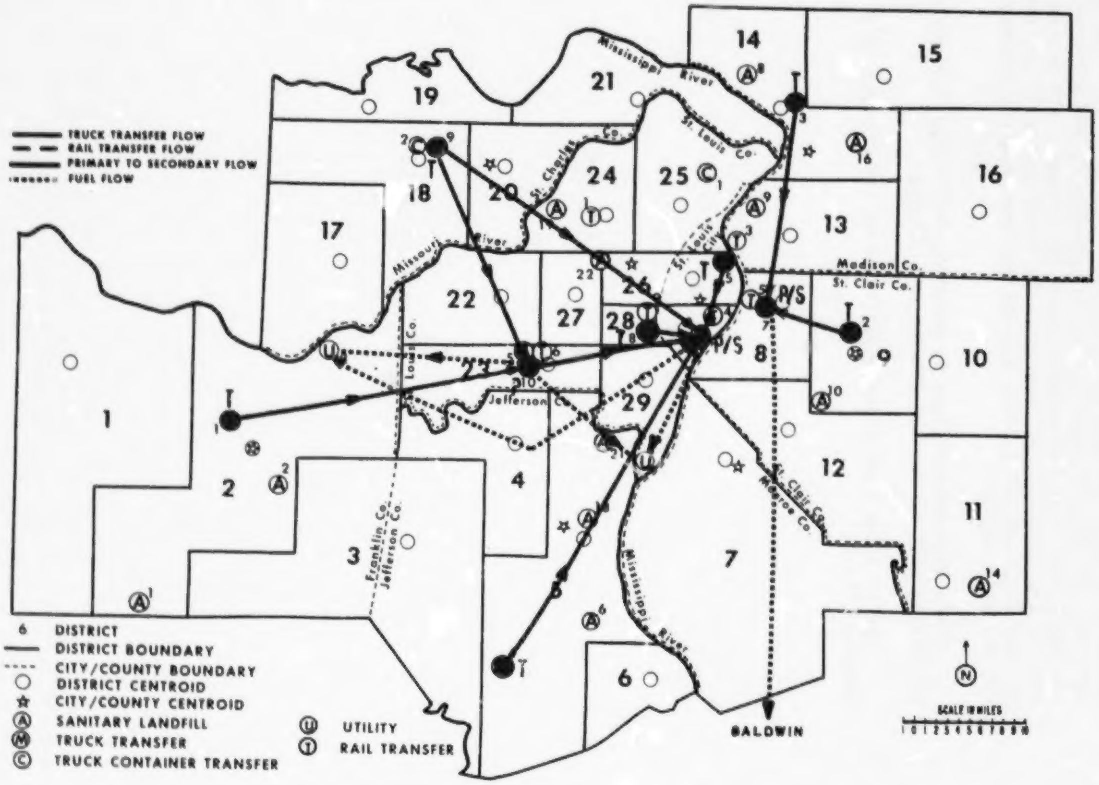
Map 9

FLOWS TO INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN C


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER

Map 10

FLOWS FROM INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN C


TRUCK TRANSFER FLOW
RAIL TRANSFER FLOW
PRIMARY TO SECONDARY FLOW
FUEL FLOW
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
St. Louis City
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
BALDWIN
SCALE IN MILES
P/S

Run E

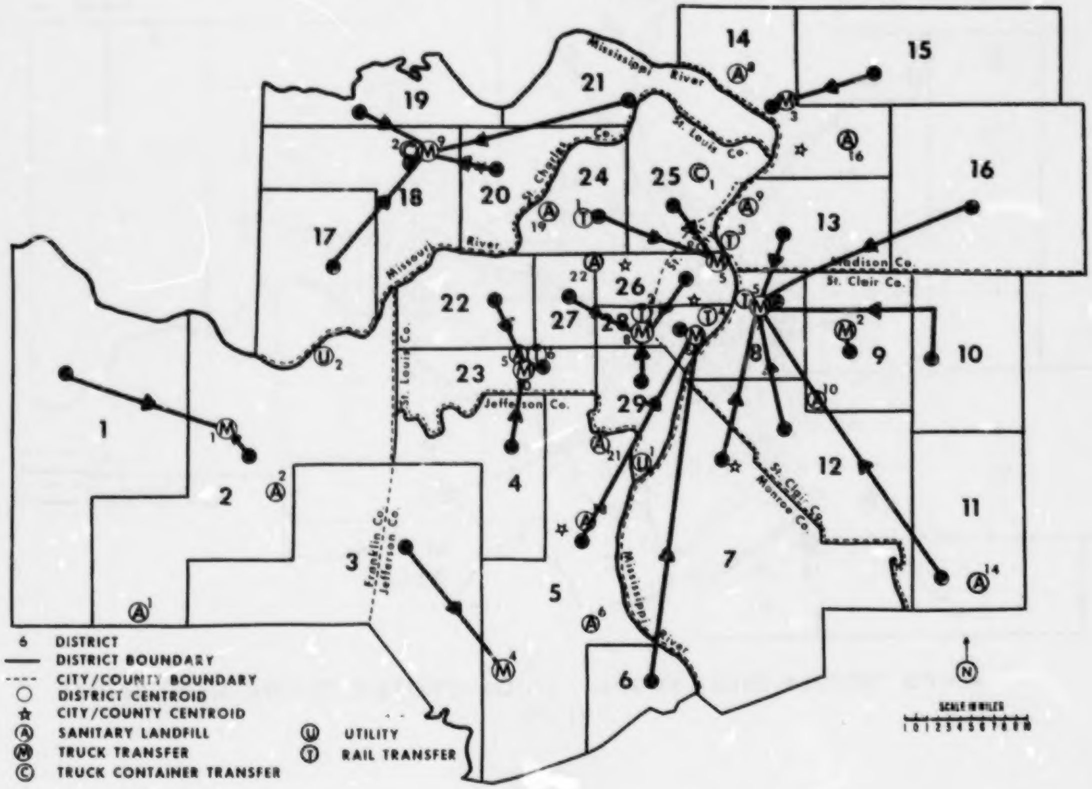
In run E, commercial tonnages, which tend to be heavier in the central city, were cut in half, representing the effect of non-participation by a major private solid waste collection firm. The effect on the solution, as shown in map 12, was to suburbanize the solution. Site M6, the South St. Louis incinerator site, was dropped, and replaced by site M10, in the southwestern suburbs. The North St. Louis incinerator site, M5, was retained for primary processing, and provided secondary processing for the full region.

Since rail-haul of fuel is assumed, fuel flows from each primary processing site to each of Meramec and Labadie.

Map 11 shows some minor adjustments to the changes in primary processing sites.

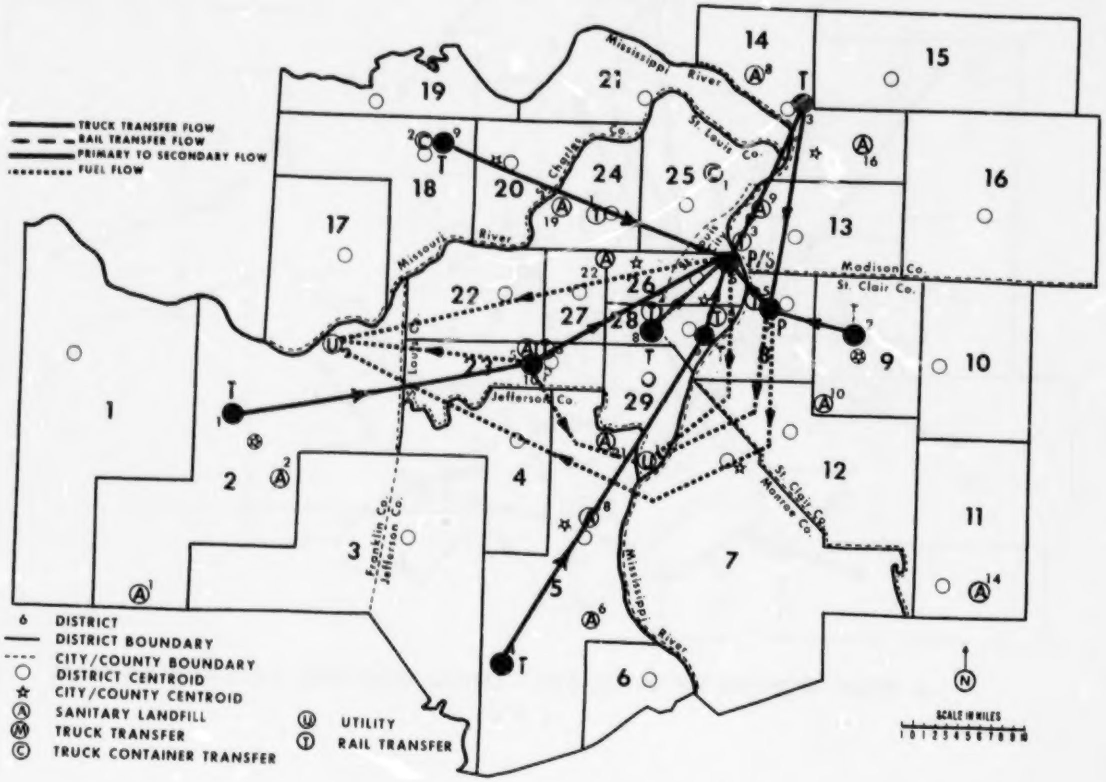
Map 11

FLOWS TO INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN E


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10

Map 12

FLOWS FROM INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN E


TRUCK TRANSFER FLOW
RAIL TRANSFER FLOW
PRIMARY TO SECONDARY FLOW
FUEL FLOW
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10
N
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
P/S
P
T
1
2
3
4
5
6
7
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29

Run F

In run F, primary processing was forced to the two utility sites, Meramec and Labadie, with a constraint of 2,000 tons per day at Meramec. A phase 3 solution was obtained.

Map 13 shows a modified pattern of flows to initial offload points. Four districts, districts 3, 17, 19, and 22, shipped raw refuse directly to U2, the Union Electric Plant at Labadie. One district, Illinois district 12, shipped raw refuse interstate to M6, the South St. Louis incinerator site. Site T1 was introduced for the first time as an initial offload point.

Map 14 shows a similarly modified pattern of processing and flows. Perhaps due to the tonnage constraint at Meramec, all primary processing, and secondary processing also, was concentrated at Labadie.

Transfer haul is largely by rail -- a process unused in earlier runs.

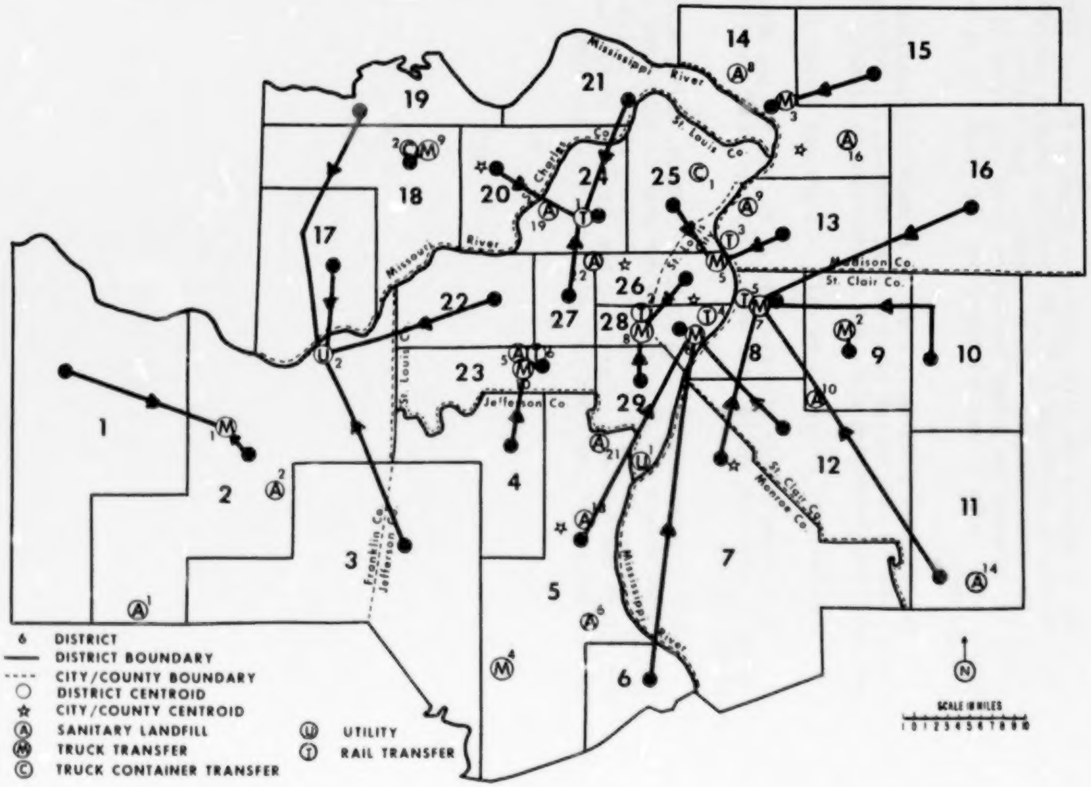
Truck transfer was selected only at M1, M2, M9, and M10, for a total volume of only 218,100 tons per year, less than 9% of the total tonnage of the region.

Rail transfer was selected at M3, M5, M6/T4, M7/T5, M8/T2, and T1, for a total volume of 2,296,800 tons per year or 92% of the total tonnage of the region. In one case (M2 to M7, by van; thence to Labadie by rail) both truck and rail were selected in the volume of 86,900 tons per year, so that the sum of truck and rail percentages exceeds 100%.

45

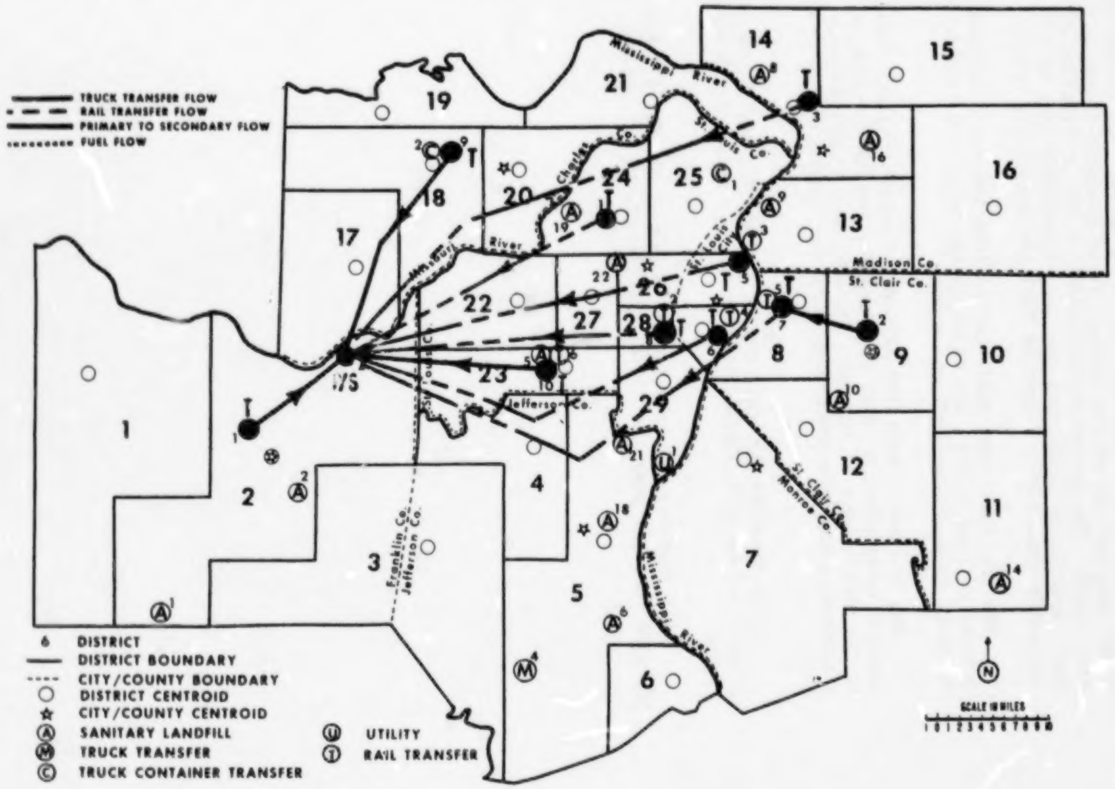
Map 13

FLOWS TO INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN F


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
Mississippi River
Missouri River
St. Louis Co.
St. Charles Co.
Jefferson Co.
Franklin Co.
Madison Co.
St. Clair Co.
Monroe Co.
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10

Map 14

FLOWS FROM INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN F


TRUCK TRANSFER FLOW
RAIL TRANSFER FLOW
PRIMARY TO SECONDARY FLOW
FUEL FLOW
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10
N
Mississippi River
Missouri River
Charles Co.
St. Louis Co.
St. Louis City
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
1/S
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29

Run F-1

Run F-1 was a stripped-down version of run F, with a phase 4 solution.

The maximum tonnage constraint at Meramec was rasied from 2,000 to 4,062 tons per day of raw refuse, based on consultation with Union Electric staff. The constraint represents a 65% utilization of a shredded fuel capacity of 5,000 tons per day, translated back to raw refuse through a factor of 0.8 tons of fuel per ton of raw refuse.

Map 15, shows some modification from the run F pattern of flows to initial offload points, the major change being the introduction of U1, Meramec, as an initial offload point.

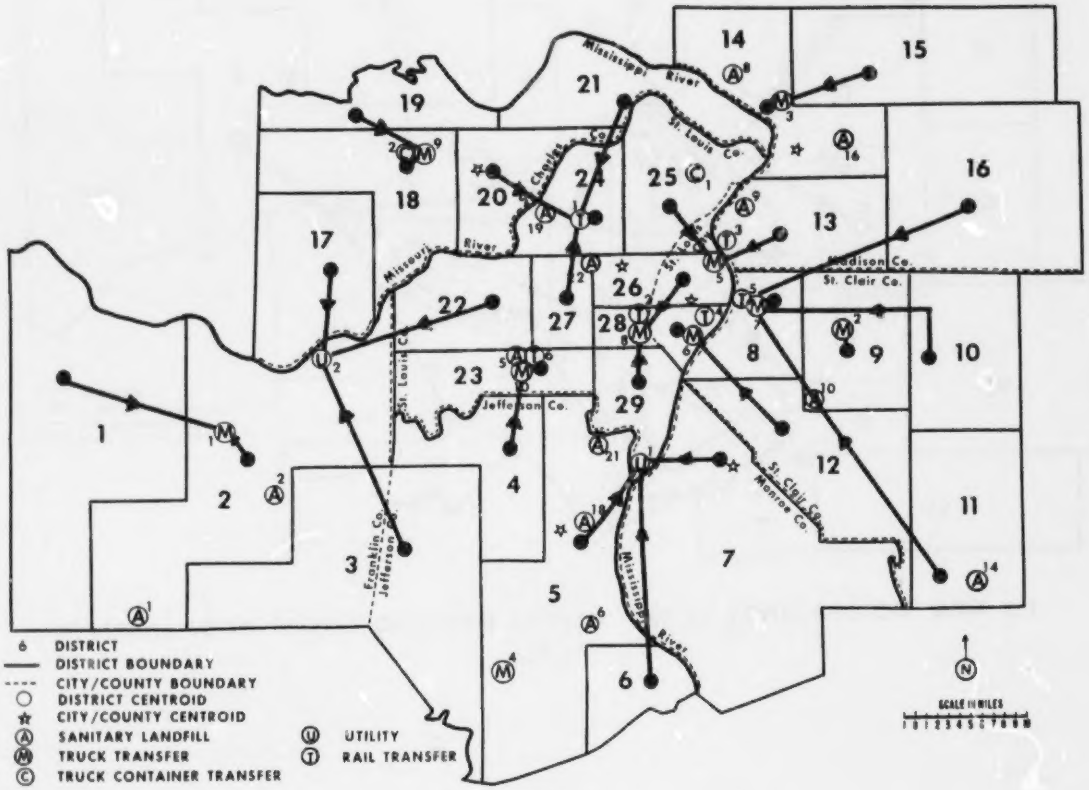
Map 16 shows a modified pattern of processing and flows. Primary processing takes place at both U1, Meramec, and U2, Labadie, with the former at the upper limit of tonnage. Due to the distance between the two plants, a separate secondary processing plant was selected at each of the two locations.

Truck transfer was selected at M1, M2, M5, M6, M7, M8, M9, M10, for a total volume of 1,932,500 tons per year, or 77% of the tonnage of the region.

Rail transfer was selected at M3 and at T1, for a total volume of 427,300 tons per year, or 17% of the tonnage of the region.

Map 15

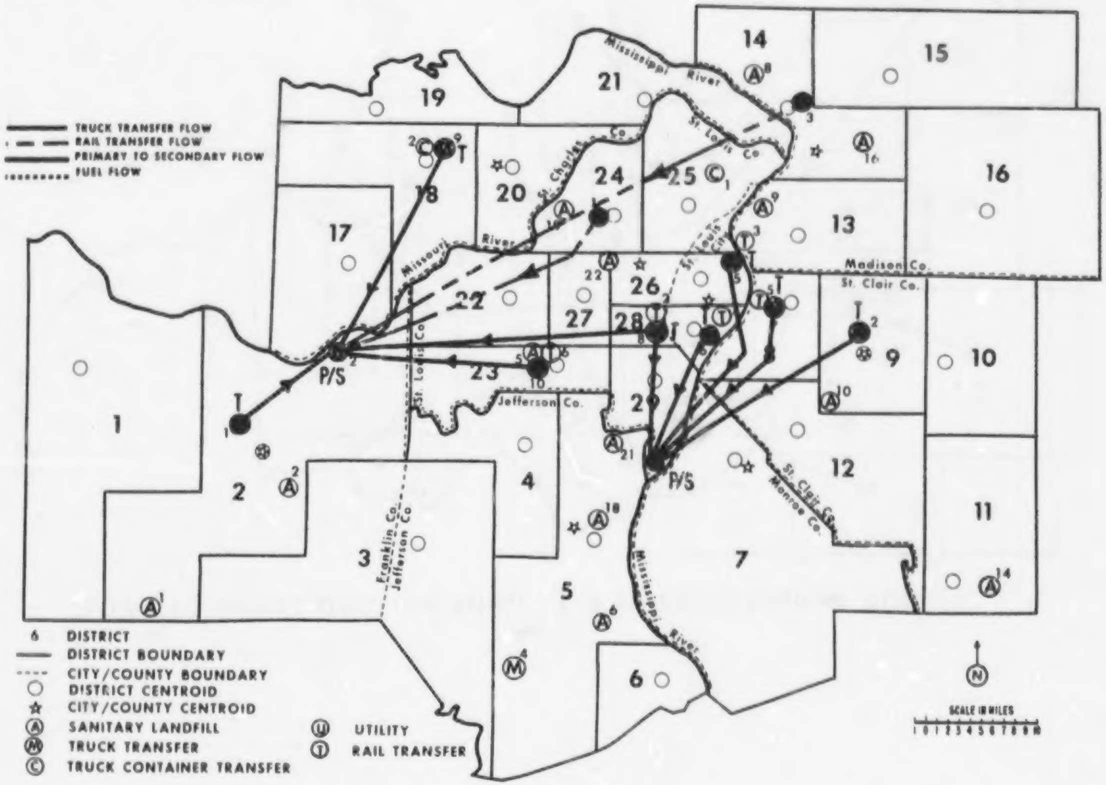
FLOWS TO INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN F-1



Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
St. Louis City
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER

Map 16

FLOWS FROM INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN F-1



TRUCK TRANSFER FLOW
RAIL TRANSFER FLOW
PRIMARY TO SECONDARY FLOW
FUEL FLOW
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
Ⓐ SANITARY LANDFILL
Ⓜ TRUCK TRANSFER
Ⓒ TRUCK CONTAINER TRANSFER
Ⓤ UTILITY
Ⓣ RAIL TRANSFER
1
2
3
4
5
6
7
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
P/S
P/S
T
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
St. Louis City
St. Louis Co.
Jefferson Co.
Franklin Co.
Jefferson Co.
Madison Co.
St. Clair Co.
St. Clair Co.
Monroe Co.
N
SCALE IN MILES

Cross-Analysis of Costs for the Static St. Louis Runs

Perhaps the most significant result of the static St. Louis runs is the narrow range of costs. With reference to Figure 5, note that the largest cost difference is between run F at $1.95 per ton and run B at $1.25 per ton (4 mills less than run A). Yet even this small difference of 70¢ a ton is an exaggeration, for run B uses an unrealistically favorable assumption of truck-haul of fuel, in excess quantities, to Meramec, and run F uses an unrealistically unfavorable assumption of capacitation at Meramec. The difference of 15¢ per ton between run A-1 and run F-1 is probably a more realistic estimate of the cost difference between on-site and off-site processing, slightly favorable towards processing off-site.

Very little landfill was selected when it was offered. The revenues assumed for fuel and secondary materials proved to be too attractive to permit much landfill; the one case of a landfill in the solution was of a district which was far removed from the nearest point of entry into the resource recovery system, and close to a landfill.

Removing interstate flows (run C) required the use of two secondary recovery plants, and also, perhaps because of the inability of primary processing residues to flow to a single secondary recovery center, caused a relocation of primary processing in Missouri towards the west (site M10 in run C in place of site M5 in run A-1). The cost impact was small: 40¢ per ton over run A-1.

A similar movement of processing towards the west (here, towards the suburbs) was generated in run E (half commercial tonnages). In this case, the loss of commercial tonnages shifted the distribution of tonnage generation towards the suburbs, since commercial tonnages tend to be concentrated in urban areas. Again, the cost impact was small: 31¢ per ton over run A-1.

In general, the static runs suggest that the resource recovery system can serve the entire region under study at a cost which should be competitive with sanitary landfill.

There is a slight preference for processing in downtown locations, particularly at the North and South St. Louis incinerator sites (sites 505 (M5) and 506 (M6)).

The Bureau of Mines Process was always selected for residue processing, and tended strongly to a single location for the entire region.

The Dynamic Run

One case, St. Louis G, was run in the dynamic mode, representing a 25-year planning period in increments of 3, 10, 7, and 5 years. Since there was no decision-oriented issue pressing for the use of the dynamic model, St. Louis G was actually a test of the dynamic modeling technique itself. St. Louis G sources are displayed in Figure 14; sites and processes are displayed in Figures 11 and 12.

Figure 11

SITES AND SITE LOCATIONS FOR THE DYNAMIC ST. LOUIS RUN

SITE	LOCATION				(FOR ULTIMATE SITE ONLY) ACRE-FEET AVAILABLE
	LONG		LAT		
	DEG.	MIN	DEG.	MIN	
SITE 501 M1 TRANS	91	01.1	38	26.8	
SITE 506 M6 PROCESSING	90	16.7	38	34.9	
SITE 507 M7 TRANS/PYROLYSIS	90	08.8	38	37.7	
SITE 509 M9 TRANS	90	42.2	38	49.7	
SITE 510 M10 TRANS/PYROLYSIS	90	30.6	38	30.8	
SITE 514 U1 MKT/PROCESSING	90	19.4	38	26.0	
SITE 711 A19 VIGUS QUARRY	90	28.9	38	44.7	20000

Figure 12

PROCESS OPTIONS/ST. LOUIS
FOR DYNAMIC RUN

TRANSFER STATION

901 PACKER TO TRANSFER VAN

PROCESSING

935 GAS PYROLYSIS
955 COMPOSITE OF:

  905 PRIMARY PROCESSING, DRY FUEL
  906 SECONDARY PROCESSING
    BU MINES PROCESS AT 13% OF PRIMARY

907 SANITARY LANDFILL

The dynamic model provides capacity carryforward and land availability carryforward in a model which seeks the minimum total (discounted) cost over the entire planning period. The model is permitted to overbuild capacity in an earlier period in order to allow for growth, and to abandon one process when a better one comes along. Either of these measures would be taken if and only if the total system cost were thereby reduced. In order to permit these two measures, underutilization (S) activities are provided. If taken in an earlier period, they represent overbuilding to allow for growth; if taken in a later period, they represent abandonment of capacity due to economic obsolescence. In Figure 13, which presents the options offered and selected in St. Louis G, both of these uses of S activities were made; overbuilding to allow for growth (Process 901 at two locations) and abandonment of capacity due to economic obsolescence (Process 955, which was a composite of shredded fuel and secondary processing). In figure 13, K (capacity building) and S (underutilization) activities are shown. In this figure, the selected time period rather than the selected process has been boxed.

Note that process 955 was built in the first period, but abandoned in the second period (requiring S activities in the 2nd and 3rd period to do so) when gas pyrolysis became available at a favorable price.

Gas pyrolysis (Process 935) was built at two sites, 506 (M6) and 507 (M7), in the second period. The M6 site was expanded in the 3rd period; the M7 site was expanded in the 4th period; and an additional gas pyrolysis site was built in that period at site 510 (M10), to allow for transportation savings in the face of considerably enlarged tonnages. All of this required considerable rerouting, which is displayed graphically in the following subsection, and described in full numerical detail in Chapter 5.

A transfer station was built at site 501 (M1) in the 1st period with enough capacity for the 3rd period (requiring S activities in the 1st and 2nd periods). A second transfer station was built in the 2nd period at site 509 (M9) with enough capacity for the 4th period (requiring S activities in the 2nd and 3rd periods).

Cross-Period Structural Analysis of the Dynamic St. Louis Run

In the dynamic run, a map pair is used to display each of the four model periods of the run.

Maps 18, 20, 22, and 24 display a time transition of processing and transfer.

In the first period, a shredded fuel processing plant with secondary recovery of the heavy end was bought at M6, the South St. Louis Incinerator site. This was abandoned in the second period, with loss of all unused capital, when a gas pyrolysis process became available at a very favorable price -- $2 per million BTU of pyrolytic gas. Gas pyrolysis was bought at M6 and M7 in the second period, expanded at M6 in the third period, expanded at M7 in the fourth period, and an additional plant was added at M10 in the fourth period.

Figure 13

ST. LOUIS G: DYNAMIC RUN, GAS PYROLYSIS IN 2ND PERIOD RUN SUMMARY

115 ROWS 287 COLUMNS +2 SLACKS PHASE 3 SOLUTION OBJECTIVE VALUE*: -178939.3750 DISCOUNTED AVERAGE $/TON: –1.890775

SITE	PROCESS	SEGMENT	PERIOD	ACTIVITY LEVEL*	(SEGMENT)
501	901	13	$\boxed{1}$	K's: 75.9	(2)
			2		
			3		
			$\boxed{4}$	98.8	(2)
506	935	01	$\boxed{2}$	2226.9	(1)
			$\boxed{3}$	1220.7	(1)
			4		
506	955	13	$\boxed{1}$	2466.4	(3)
			2		
			3		
			4		
507	901	13	1		
			2		
			3		
			4		
507	935	01	$\boxed{2}$	825.6	(1)
			3		
			$\boxed{4}$	680.1	(1)
509	901	13	1		
			$\boxed{2}$	271.0	(3)
			3		
			4		
510	901	13	1		
			2		
			3		
			4		
510	935	01	2		
			3		
			$\boxed{4}$	407.0	(1)

SITE	PROCESS	SEGMENT	PERIOD	ACTIVITY LEVEL*	(SEGMENT)
514	955	13	1		
			2		
			3		
			4		
711	907	13	1		
			2		
			3		
			4		

UNDERUTILIZATION (S) ACTIVITIES ARE AVAILABLE FOR EACH SITE PROCESS IN EACH PERIOD; ONLY SELECTED S ACTIVITIES ARE LISTED. SEGMENT DOES NOT APPLY.

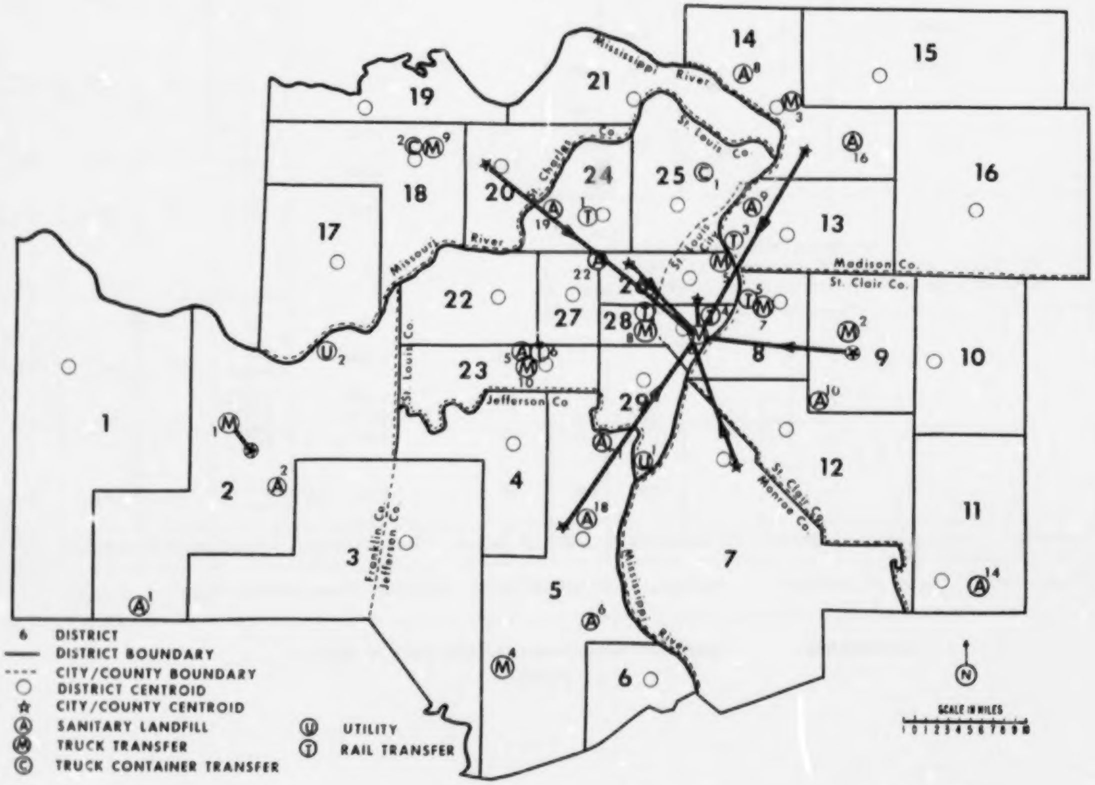
SITE	PROCESS	SEGMENT	PERIOD	ACTIVITY LEVEL*	(SEGMENT)
501	901		1	S's: 36.8	
501	901		2	25.1	
506	955		2	2466.4	
506	955		3	2466.4	
509	901		2	156.4	
509	901		3	75.7	

NO ACTIVE CONSTRAINTS *OBJECTIVE VALUE IN DISCOUNTED THOUSANDS OF DOLLARS OVER PLANNING PERIOD;

ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR CAPACITY BUILT (K) OR IN THOUSANDS OF TONS PER YEAR UNDERUTILIZED (S).

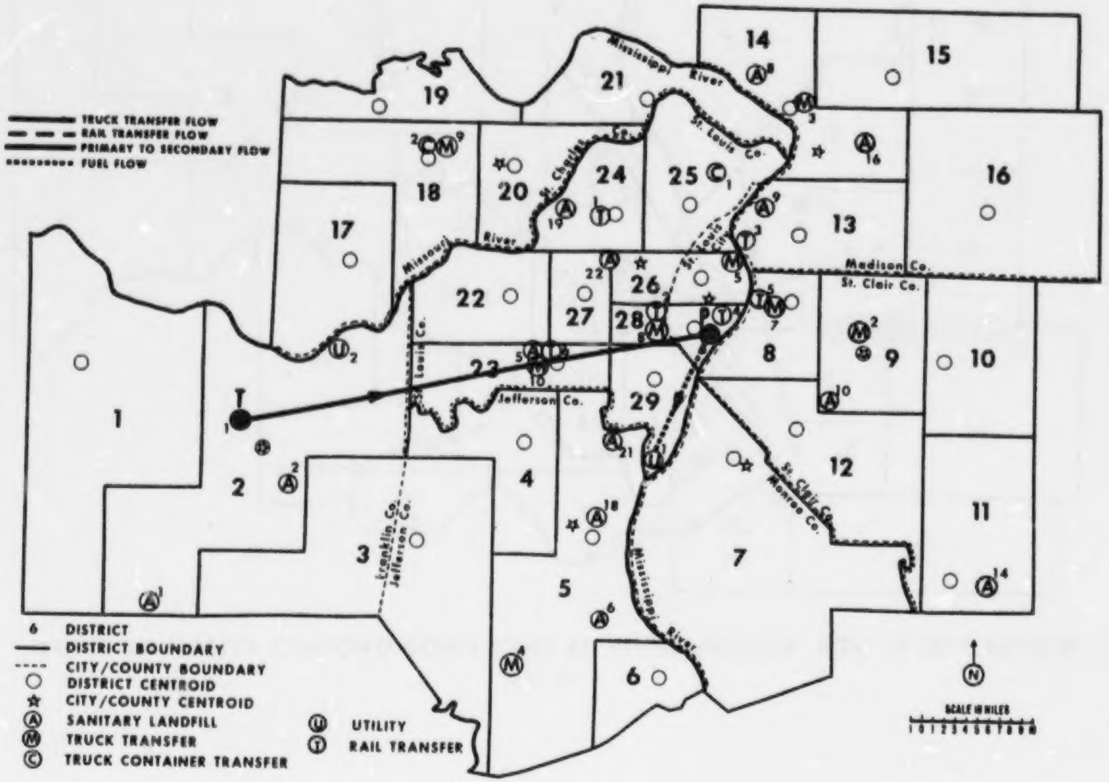
Map 17

FLOWS TO INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN G-1st PERIOD


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
27
28
29
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
St. Louis City
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER

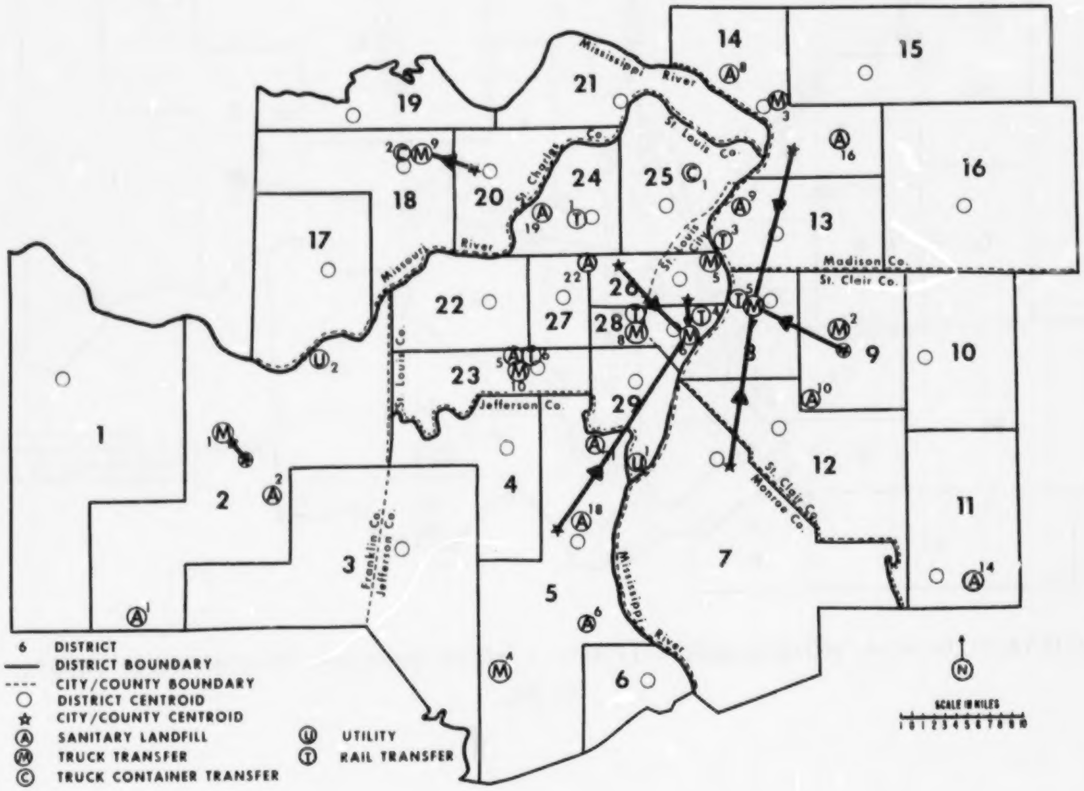
Map 18

FLOWS FROM INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN G-1st PERIOD


TRUCK TRANSFER FLOW
RAIL TRANSFER FLOW
PRIMARY TO SECONDARY FLOW
FUEL FLOW
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
St. Louis
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29

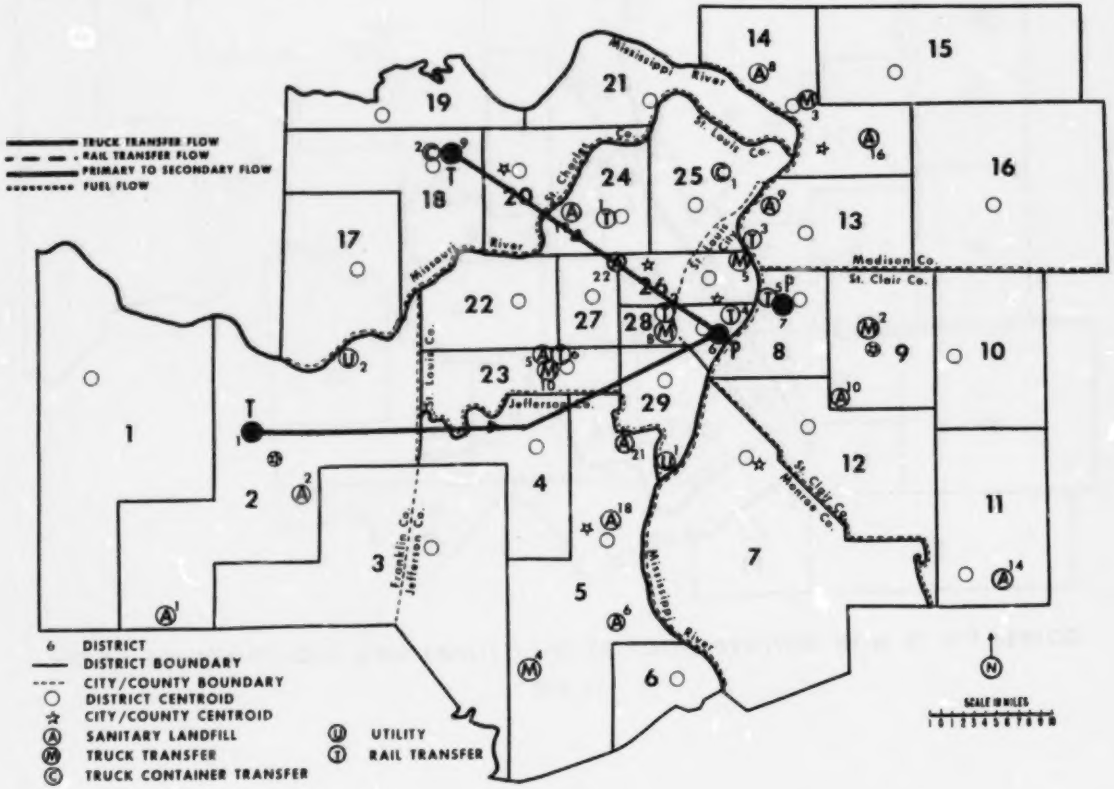
Map 19

FLOWS TO INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN G-2nd PERIOD


Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
St. Louis City
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10

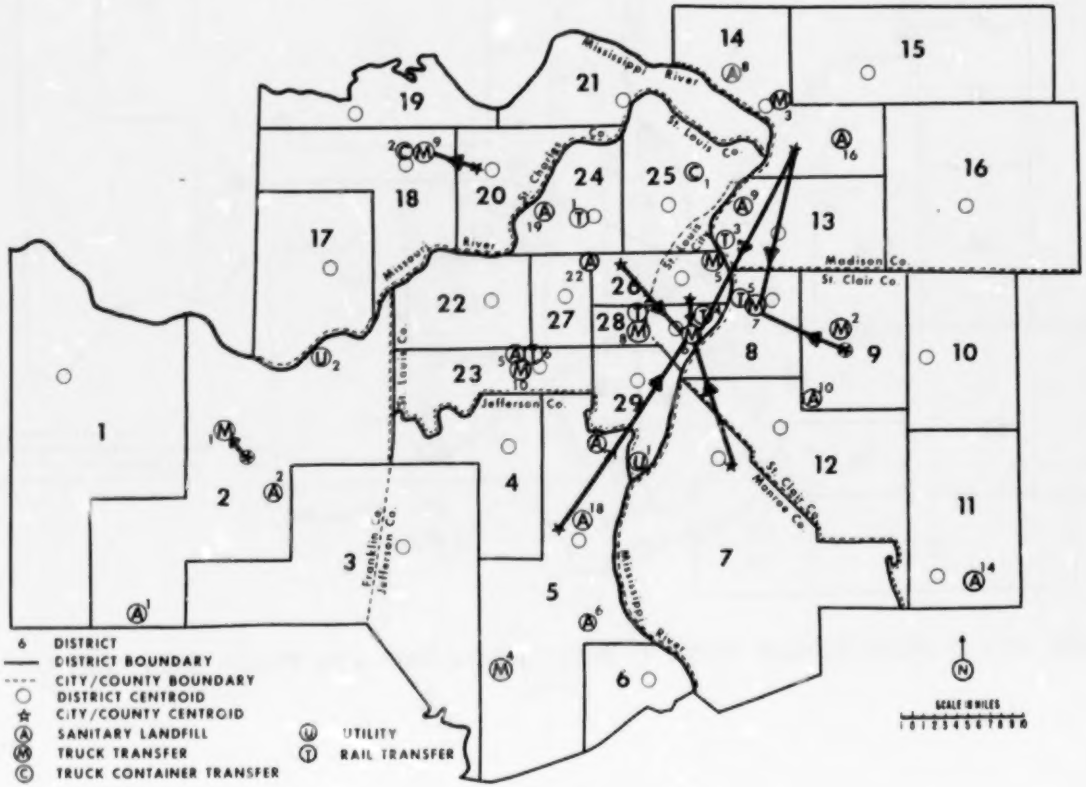
Map 20

FLOWS FROM INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN G-2nd PERIOD


TRUCK TRANSFER FLOW
RAIL TRANSFER FLOW
PRIMARY TO SECONDARY FLOW
FUEL FLOW
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
St. Louis City
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
SCALE IN MILES
N
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
T
P

Map 21

FLOWS TO INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN G-3rd PERIOD



1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
St. Louis City
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
St. Louis Co.
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10
N
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER

A transfer station was bought at M1 in the first period, with enough slack capacity to allow for growth through the third period. The station was replaced with a larger plant in the fourth period (its useful life had expired at the end of the third period).

A second transfer station was bought at M9 in the second period with enough slack capacity to allow for growth through the fourth period.

This pattern of plant building, selected by the model to conserve the intercept costs of capacity expansion, required a period-to-period adjustment in initial offload points (as displayed in maps 17, 19, 21, and 23) and in transfer flows (as described in maps 18, 20, 22, and 24).

The Massachusetts Exercise Program

A new set of runs was performed on a slightly modified version of the same Massachusetts/New Hampshire region studied earlier.[9] Zone 1 was divided into two zones, so that there are 14 zones for waste generation in total. These zones, their locations, and their tonnages are displayed in Figure 14. Additional processing locations have been added in the new zone 14, and in zone 3 (Haverhill), and the St. Louis shredded fuel process has been made available in Haverhill, Newburyport, Gloucester, Lowell East, and in the new zone 14 (called South Essex Inner). Otherwise, all options made available in the earlier Massachusetts runs were continued.

The run series consists of a base case and four parameterizations for a total of 13 runs as follows:

Base Case

Run A	Base Case Base Case Variants A-2, A-3, A-4

Tonnage Variant

Run B1	double tonnage
Run B2	half tonnage

Region Size Variant

Transportation distances use flat earth straight line measurements from longitude and latitude. Average speeds are as follows:

Run C1	45 mph
Run C2	20 mph
Run C3	10 mph

---

[9] E. B. Berman and H. J. Yaffe, Op. Cit.

Figure 14

DISTRICTS, CENTROID LOCATIONS AND TONNAGE GENERATION ASSUMPTIONS FOR THE MASSACHUSETTS EXERCISE PROGRAM

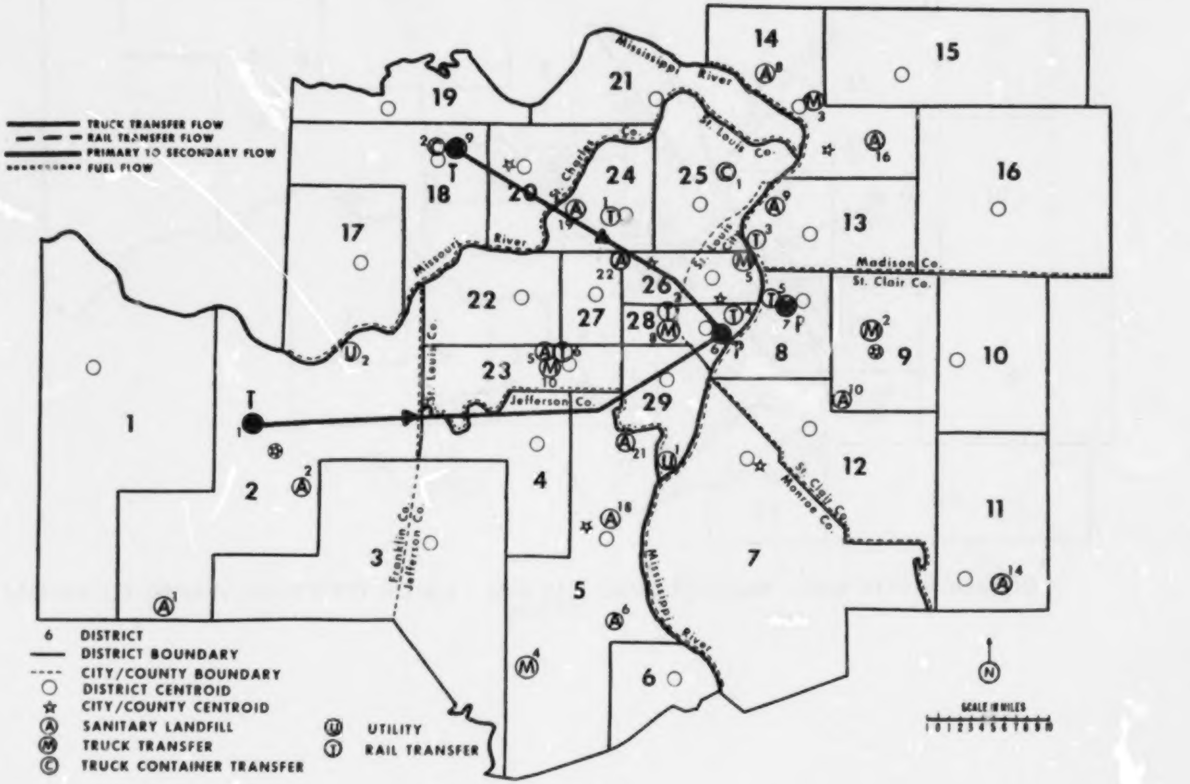
	DISTRICT	CENTROID LOCATION				TONNAGE 000 TONS PER YEAR*
		LONG		LAT		PERIOD
		DEG.	MIN	DEG.	MIN	1
101	SOUTH ESSEX OUTER	70	55.6	42	29.9	189.7
102	LAWRENCE	71	10.0	42	42.1	157.7
103	HAVERHILL	71	04.5	42	46.5	55.7
104	NEWBURYPORT	70	54.9	42	49.2	43.4
105	E CENTRAL ESSEX	70	52.0	42	41.6	12.0
106	GLOUCESTER	70	38.4	42	37.2	45.8
107	LOWELL EAST	71	19.2	42	38.0	129.1
108	LOWELL WEST	71	24.3	42	37.4	38.3
109	LOWELL SOUTH	71	17.0	42	32.5	53.4
110	EAST MIDDLESEX	71	09.3	42	34.6	108.0
111	NEW HAMPSHIRE	71	19.0	42	51.0	115.1
112	RESCO COMMUNITIES	70	58.8	42	26.9	186.0
113	S W CENTRAL ESSEX	70	56.4	42	38.1	11.4
114	SOUTH ESSEX INNER	70	59.0	42	32.9	72.5

---

*Tonnages were doubled for N.E. Massachusetts B-1 and halved for N.E. Massachusetts B-2.

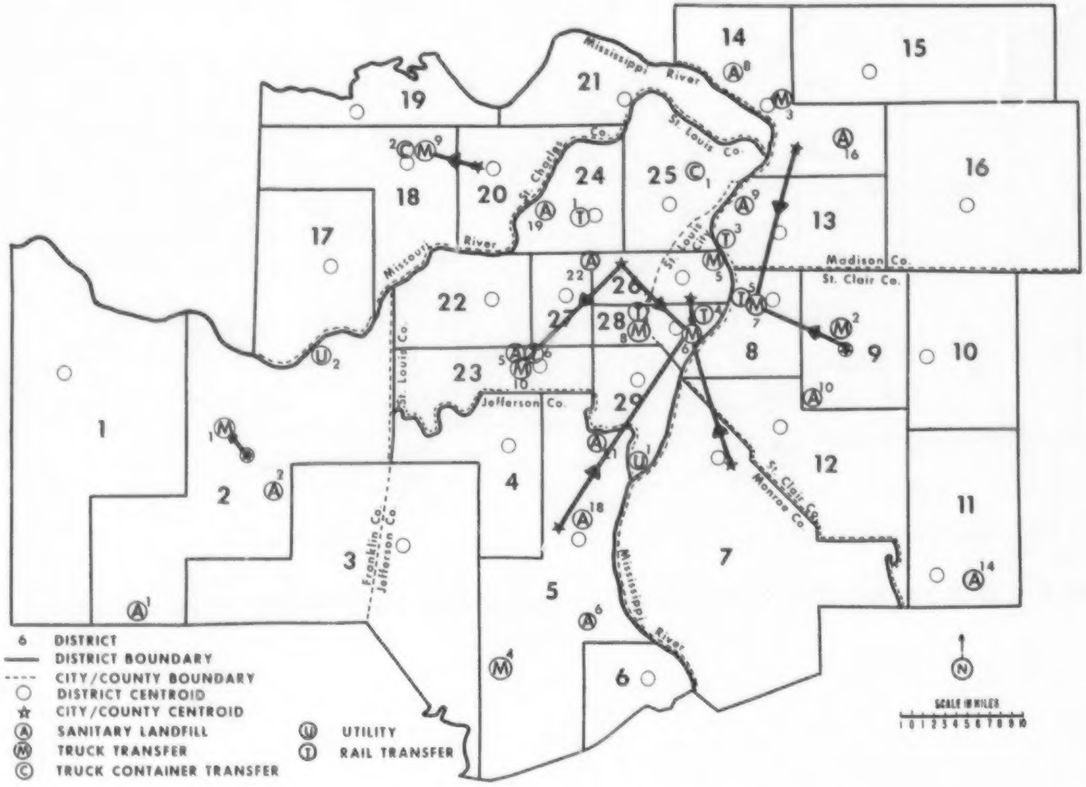
Map 22

FLOWS FROM INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN G-3rd PERIOD


TRUCK TRANSFER FLOW
RAIL TRANSFER FLOW
PRIMARY TO SECONDARY FLOW
FUEL FLOW
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
St. Louis City
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10

Map 23

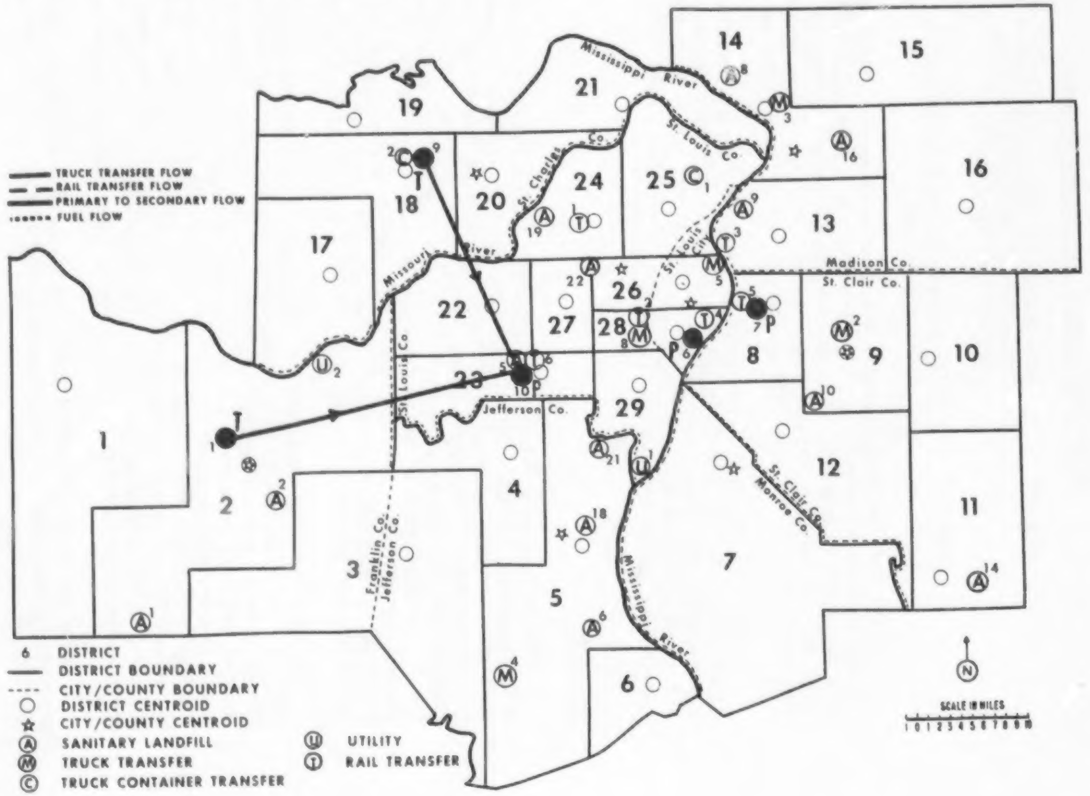
FLOWS TO INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN G-4th PERIOD



1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
St. Louis City
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
N
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10

Map 24

FLOWS FROM INITIAL OFFLOAD POINT : THE ST. LOUIS REGION, RUN G-4th PERIOD


TRUCK TRANSFER FLOW
RAIL TRANSFER FLOW
PRIMARY TO SECONDARY FLOW
FUEL FLOW
6 DISTRICT
DISTRICT BOUNDARY
CITY/COUNTY BOUNDARY
DISTRICT CENTROID
CITY/COUNTY CENTROID
SANITARY LANDFILL
TRUCK TRANSFER
TRUCK CONTAINER TRANSFER
UTILITY
RAIL TRANSFER
Mississippi River
Missouri River
St. Charles Co.
St. Louis Co.
St. Louis City
Madison Co.
St. Clair Co.
Monroe Co.
Jefferson Co.
Franklin Co.
SCALE IN MILES
N
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29

The average speed is used as a numeraire of region size.

Truck Constraint Variant

Run D-1	105,000 trucks per year maximum
Run D-2	40,000 trucks per year maximum

Intercept (Economy of Scale) Variant

Run E-1	all processing cost intercepts are doubled (not including transfer stations and landfill).
Run E-2	all processing cost intercepts as above are halved.

Sites for the Massachusetts exercise program are displayed in figure 15 and process alternatives in Figure 16. Note in Figure 16 that there are two dummy processes, 936, and 946, which permit differentiated revenues for incinerator residue and shredded fuel heavy end residue as they are generated in the same secondary recovery process (process 906).

Figure 17 displays a summary of the Massachusetts exercise program, and Figures 18, 19, and 20 display site/process/linear segments offered and selected for three runs, Run A (all options, base case) Run C-1 (CROW-FLY at 45 mph) and Run D-2 (tight truck constraint). The full set of options and selections may be found in Section 4.

Analysis

One of the more interesting tradeoffs is in the locating of secondary processing (process 906). That process, if located in Lowell (site 607) receives the value of an EPA grant, worth an amortized value of $634.1 per day. This grant value is lost at all other locations (The process was offered in Haverhill, site 603, and South Essex Inner, site 614.) In those runs in which transportation cost is low (e.g., the low tonnage variant run, B-2, and the small region variant, run C-1) the EPA grant pulls that process to 607 (Lowell). In many other runs, the transportation savings pull the process to 603 (Haverhill) or 614 (Danvers).

A total of four base case variants were run. The Massachusetts region is like a doughnut, with heavy concentrations of population around the periphery, and a low-density "hole" in the middle. Because of this, several variants were run, using alternative starting bases to force the model to consider alternate solutions around the rim of the doughnut. The four solutions were close in cost, but the best of them, A-4, the all-Haverhill solution (sites 503/603), was considered the base case, and used as the starting basis for all other runs (except run D-2, in which a new algorithm for a computer-generated starting basis was tested).

Other variants generated solutions ranging from one to three primary processing locations, in addition to RESCO operating at its minimum of 600 TPD.

Figure 15

SITES AND SITE LOCATIONS FOR THE MASSACHUSETTS EXERCISE PROGRAM

SITE		LOCATION				(FOR ULTIMATE SITE ONLY) ACRE-FEET AVAILABLE
		LONG		LAT		
		DEG.	MIN	DEG.	MIN	
SITE 501	SALEM INCINERATOR/TR	70	55.6	42	29.9	
SITE 502	LAWRENCE INCIN/TRANS	71	08.3	42	42.8	
SITE 503	HAVERHILL PROCESSING	71	07.3	42	45.7	
SITE 504	NEWBURYPORT TR/PROC	70	54.9	42	49.2	
SITE 506	GLOUCESTER TR/PROC	70	43.3	42	37.1	
SITE 507	LOWELL INCIN/TR/PROC	71	21.4	42	37.7	
SITE 510	EA MIDDLESEX TRANS	71	09.3	42	34.6	
SITE 512	RESCO PROCESSING	70	58.8	42	26.9	
SITE 514	SO ESSEX INNER TR/PR	70	58.7	42	33.6	
SITE 603	HAVERHILL SCDY RECOV	71	07.3	42	45.7	
SITE 607	LOWELL EA SCDY RECOV	71	21.4	42	37.7	
SITE 614	SO ESX INR SCDY RECOV	70	58.7	42	33.6	
SITE 633	HAV DUMMY INCIN RES	71	07.3	42	45.7	
SITE 634	SO ESX DUMMY INCIN RES	70	58.7	42	33.6	
SITE 637	LWL DUMMY INCIN RES	71	21.4	42	37.7	
SITE 643	HAV DUMMY HEAVY END	71	07.3	42	45.7	
SITE 644	SO ESX DUM HEAVY END	70	58.7	42	33.6	
SITE 647	LWL DUMMY HEAVY END	71	21.4	42	37.7	
SITE 704	AMESBURY LANDFILL	70	56.9	42	49.9	5000
SITE 705	IPSWICH LANDFILL	70	52.9	42	41.0	1000
SITE 706	GLOUCESTER LANDFILL	70	43.3	42	37.1	1000
SITE 708	LOWELL WEST LANDFILL	71	24.3	42	37.4	1000
SITE 709	LOWELL SOUTH LANDFILL	71	17.0	42	32.5	1000
SITE 710	EA MIDDLESEX LANDFILL	71	09.3	42	34.6	1000
SITE 711	NEW HAMPSHIRE LANDFILL	71	16.0	42	48.0	1000
SITE 712	RESCO LANDFILL	70	58.8	42	26.9	1000
SITE 713	SO CTRL ESX LANDFILL	71	00.0	42	36.2	1000

Figure 16

PROCESS ALTERNATIVES -- MASSACHUSETTS EXERCISE PROGRAM

PROCESS TYPE	LEVEL	PROCESS TYPE	LEVEL
901 TRANSFER STATION	A	925 DRIED SHREDDED FUEL (ECOFUEL)	B
905 SHREDDED FUEL (ST. LOUIS)	B	935 GAS PYROLYSIS	B
906 SECONDARY PROCESSING	C	936 DUMMY: INCINERATOR RESIDUE	C
915 RESCO (INCINERATOR/STEAM REC.)	B	946 DUMMY: HEAVY END	C
	RUN A ONLY:		
907 SANITARY LANDFILL	D		
917 LANDFILL OF INCINERATOR RESIDUE	D		

Figure 17

SUMMARY OF MASSACHUSETTS EXERCISE PROGRAM

	RUN	LAST PHASE	PRIMARY PROCESSING LOCATIONS	SECONDARY PROCESSING LOCATIONS	AVERAGE COST PER TON
BASE CASE	A : ALL OPTIONS	3	503, 512	614	.879
	A-2: DISPERSED STARTING BASIS	4	503, 507, 512	607	.969
	A-3: 514 STARTING BASIS	3	512, 514	614	.720
	A-4: 503 STARTING BASIS	3	503, 512	603	.677
TONNAGE PARAMETERIZATION	B-1: DOUBLE TONNAGE	4	503, 512	603	- .742
	B-2: HALF TONNAGE	4	503, 512	607	2.377
CROW-FLY (REGION SIZE PARAMETERIZATION)	C-1: 45 MPH AV. SPEED	4	503, 512	607	-1.549
	C-2: 20 MPH AV. SPEED	4	503, 512	603	.238
	C-3: 10 MPH AV. SPEED	4	503, 507, 512, 514	603	2.807
TRUCK CONSTRAINT PARAMETERIZATION	D-1: MEDIUM TRUCK CONSTRAINT; 105,000/year	3	503, 512	603	.747
	D-2: TIGHT TRUCK CONSTRAINT; 40,000/year	3	503, 507, 512, 514	607	2.709
INTERCEPT PARAMETERIZATION	E-1: DOUBLE PROCESS INTERCEPTS	4	503, 512	603	1.479
	E-2: HALF PROCESS INTERCEPTS	4	503, 512	603	- .511

512 IS ALWAYS PROCESS 515 (RESCO) AT THE MINIMUM (FORCED) LEVEL. IN RUN D-2, SITE 503 HAS PROCESS 935, GAS PYROLYSIS. ALL OTHER SITES IN ALL OTHER RUNS HAVE PROCESS 905, SHREDDED FUEL (THE UNION ELECTRIC CO. PROCESS).

Figure 18

N.E. MASSACHUSETTS A: THE BASE CASE (ALL OPTIONS) RUN SUMMARY

78 ROWS 313 COLUMNS + 16 SLACKS PHASE 3 SOLUTION: OBJECTIVE VALUE*: 1071.0181 AVERAGE $/TON .879

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	901	13	189.7	(3)	514	901	13	83.9	(2)
502	901	13				905	13		
503	905	13	1032.1	(3)		925	13		
	925	13				935	02		
	935	02			614	906	13	180.7	(2)
603	906	13			634	936	01	46.5	(1)
633	936	01			644	946	01	134.2	(1)
643	946	01			704	907	13		
504	901	13	55.4	(1)	705	907	13		
	905	13			706	907	13		
	935	01			708	907	13		
506	901	13	45.8	(1)	709	907	13		
	905	13			710	907	13		
	935	01			711	907	13		
507	901	13	220.8	(3)	712	917	01		
	905	13			713	907	13		
	935	02							
607	906	13							
637	936	01							
647	946	01							
510	901	13	108.0	(2)					
512	915	12	186.0	(1)					

ACTIVE CONSTRAINTS: NONE

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 19

N.E. MASSACHUSETTS C-1: CROW-FLY AT 45 M.P.H. RUN SUMMARY

60 ROWS 148 COLUMNS + 7 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: –1886.1833 AVERAGE $/TON: - 1.5485

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	23	189.7	(3)	510	$\boxed{901}$	23	108.0	(2)
502	901	23			512	$\boxed{915}$	12	186.0	(1)
503	$\boxed{905}$	23	1032.1	(3)	514	$\boxed{901}$	23	72.5	(2)
	925	23				905	23		
	935	02				925	23		
603	906	13				935	02		
633	936	01			614	906	13		
643	946	01			634	936	01		
504	901	12			644	946	01		
	905	12							
	935	01							
506	$\boxed{901}$	12	45.8	(1)					
	905	12							
	935	01							
507	$\boxed{901}$	23	220.8	(3)					
	905	23							
	935	02							
607	$\boxed{906}$	13	180.7	(2)					
637	$\boxed{936}$	01	46.5	(1)					
647	$\boxed{946}$	01	134.2	(1)					

ACTIVE CONSTRAINTS: NONE

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 20

N.E. MASSACHUSETTS D-2: TIGHT TRUCK CONSTRAINTS RUN SUMMARY

60 ROWS 149 COLUMNS + 7 SLACKS PHASE 3 SOLUTION OBJECTIVE VALUE*: 3299.3506 AVERAGE $/TON: 2.7086

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	23	189.7	(3)	510	901	23		
502	$\boxed{901}$	23	509.9	(3)	512	$\boxed{915}$	12	186.0	(1)
503	905	23			514	901	23		
	925	23				$\boxed{905}$	23	423.6	(2)
	$\boxed{935}$	02	112.9	(2)		925	23		
603	906	13				935	02		
633	936	01			614	906	13		
643	946	01			634	936	01		
504	$\boxed{901}$	12	43.4	(1)	644	946	01		
	905	12							
	935	01							
506	$\boxed{901}$	12	57.8	(1)					
	905	12							
	935	01							
507	901	23							
	$\boxed{905}$	23	495.6	(2)					
	935	02							
607	$\boxed{906}$	13	166.0	(2)					
637	$\boxed{936}$	01	46.5	(1)					
647	$\boxed{946}$	01	119.5	(1)					

ACTIVE CONSTRAINTS: TRUCK CONSTRAINT, 507/607/637/647; TRUCK CONSTRAINT, 514/614/634/644.

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Cross-Analysis of Solution Structures for the Massachusetts Exercise Program

The solution structures of the thirteen Massachusetts exercise program runs are displayed graphically in maps 25 through 50.

The Base Case

Run A

The four base case runs represent a configuration forcing in which the model was forced to examine major configuration changes which were close in cost, in order to insure that the very best solution was identified as the base case. This kind of forcing is a valuable adjunct to the single activity forcing which was available automatically in a phase 4 solution.

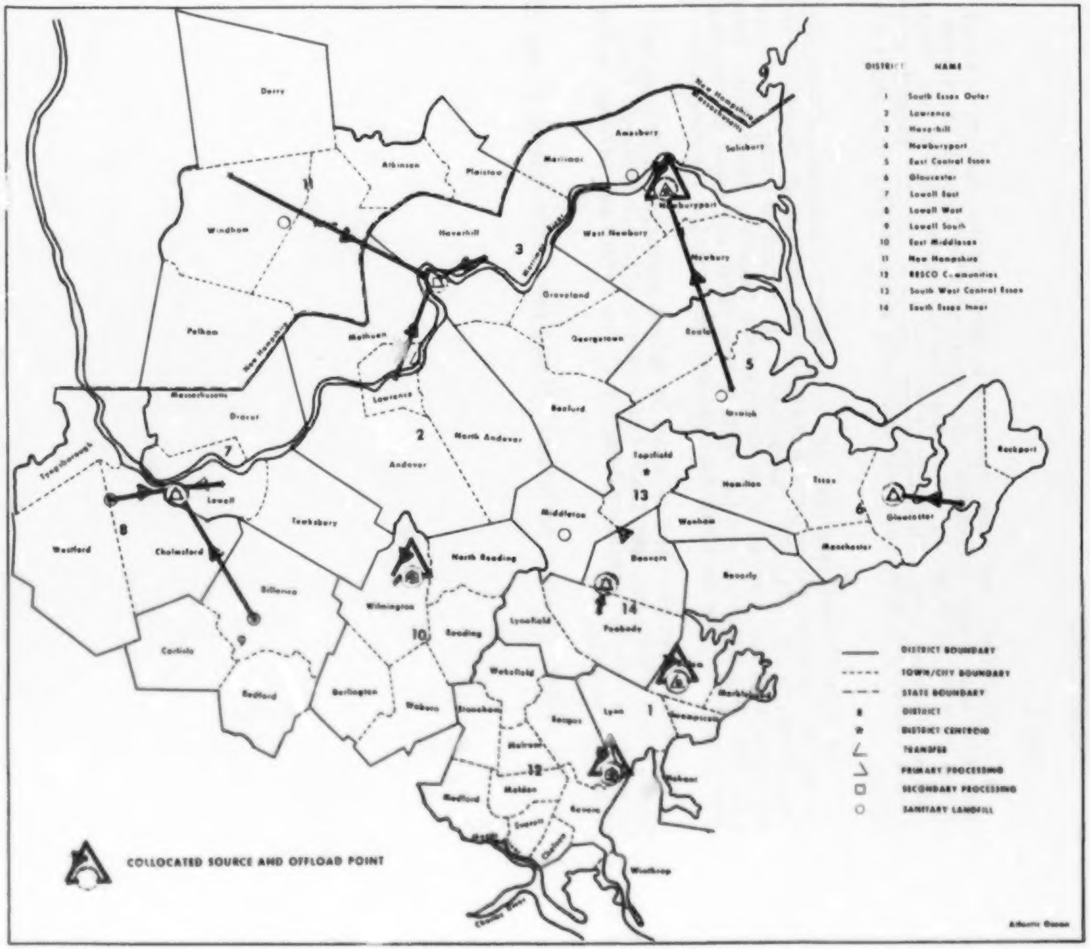
The initial base case run, run A, generated a solution, illustrated in map 26, in which all primary processing was located at Haverhill, site 503, except RESCO, site 512, operating at its forced minimum; and secondary processing was located in an intermediate location, South Essex Inner, site 514, receiving incinerator residue from RESCO and heavy end residue from Haverhill. The shredded fuel process was selected for Haverhill.

Transfer stations were selected in Salem, Newburyport, Gloucester, Lowell, East Middlesex, and South Essex Inner, with all transfer flows routed to Haverhill. Sanitary landfill of raw refuse was offered in Run A, but not selected.

The pattern of flows to initial offload point is displayed in map 25.

Map 25

FLOWS TO INITIAL OFFLOAD POINT : THE NORTHEASTERN MASSACHUSETTS REGION, RUN A

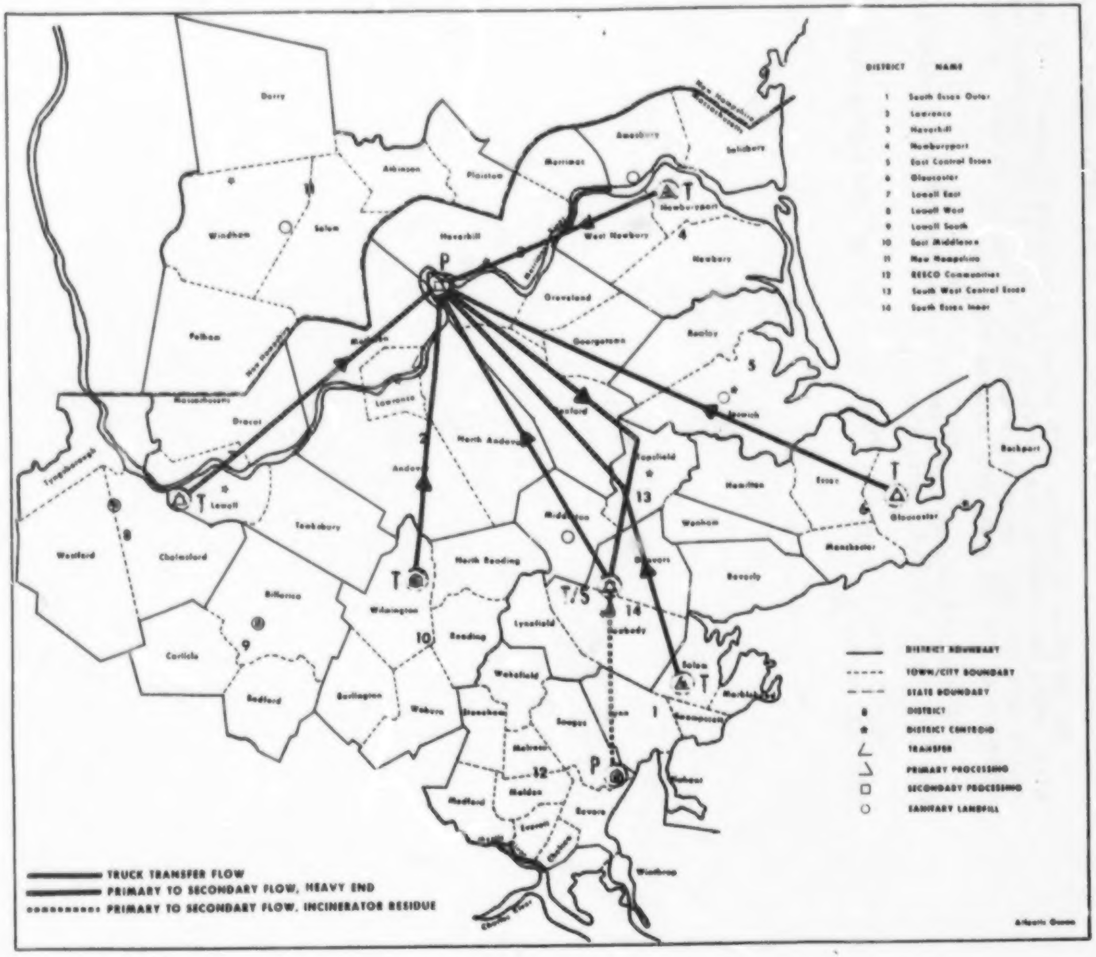


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
New Hampshire
Massachusetts
Derry
Windham
Pelham
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
Newburyport
Newbury
West Newbury
Haverhill
Merrimack River
Groveland
Georgetown
Methuen
Lawrence
Dracut
North Andover
Andover
Boxford
Rowley
Ipswich
Topsfield
Hamilton
Essex
Gloucester
Rockport
Manchester
Wenham
Beverly
Danvers
Middleton
Peabody
Salem
Marblehead
Swampscott
Lynn
Nahant
Saugus
Lynnfield
North Reading
Reading
Wakefield
Wilmington
Tewksbury
Lowell
Tyngsborough
Chelmsford
Westford
Billerica
Carlisle
Bedford
Burlington
Woburn
Stoneham
Melrose
Malden
Medford
Everett
Chelsea
Revere
Winthrop
Charles River
Atlantic Ocean
1
2
3
5
6
7
8
9
10
11
12
13
14

Reproduced from
best available copy.

Map 26

FLOWS FROM INITIAL OFFLOAD POINT : THE NORTHEASTERN MASSACHUSETTS REGION, RUN A



DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE
New Hampshire
Massachusetts
P
T
T/S
Derry
Windham
Salem
Atkinson
Plaistow
Pelham
Haverhill
Merrimac
Amesbury
Salisbury
Newburyport
West Newbury
Newbury
Groveland
Georgetown
Rowley
Ipswich
Essex
Gloucester
Rockport
Hamilton
Wenham
Manchester
Beverly
Topsfield
Middleton
Danvers
Peabody
Salem
Marblehead
Swampscott
Lynn
Nahant
Saugus
Lynnfield
North Andover
Andover
Lawrence
Methuen
Dracut
Tyngsborough
Lowell
Tewksbury
Chelmsford
Westford
Billerica
Carlisle
Bedford
Burlington
Wilmington
North Reading
Reading
Wakefield
Woburn
Stoneham
Melrose
Malden
Medford
Everett
Revere
Chelsea
Winthrop
Charles River
Atlantic Ocean

Run A-2

Run A-2 was a stripped-down version of run A, generating a phase 4 solution from a dispersed processing advanced starting point. This stripped down version was used for all runs in the series except run A.

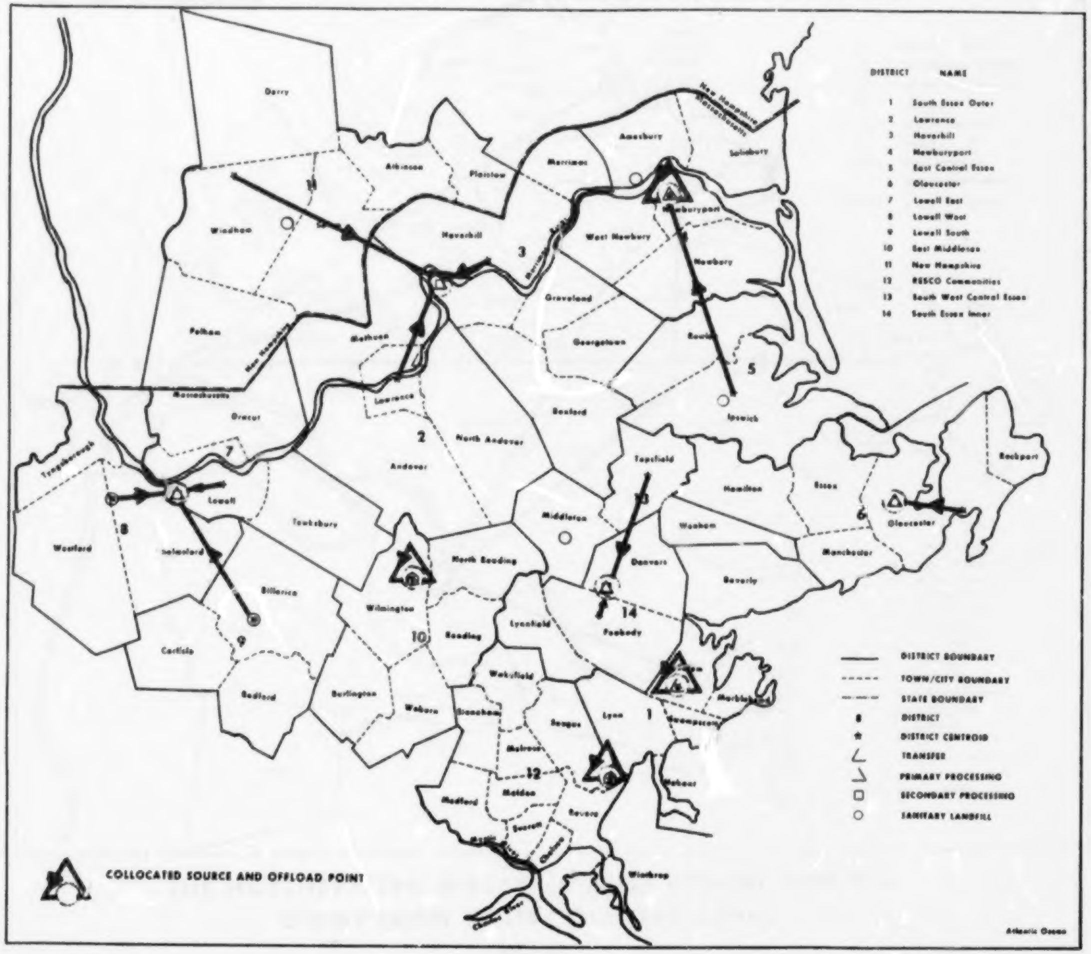
Map 28 shows a solution with primary processing at Lowell and Haverhill, using the shredded fuel process, plus RESCO at its forced minimum of 600 tons per day. Secondary processing is located at Lowell to take advantage of the EPA grant available at that site.

Transfer stations were selected at Salem, Newburyport, Gloucester, East Middlesex, and South Essex Inner.

Map 27 shows a pattern of flows to initial offload points which is identical to run A.

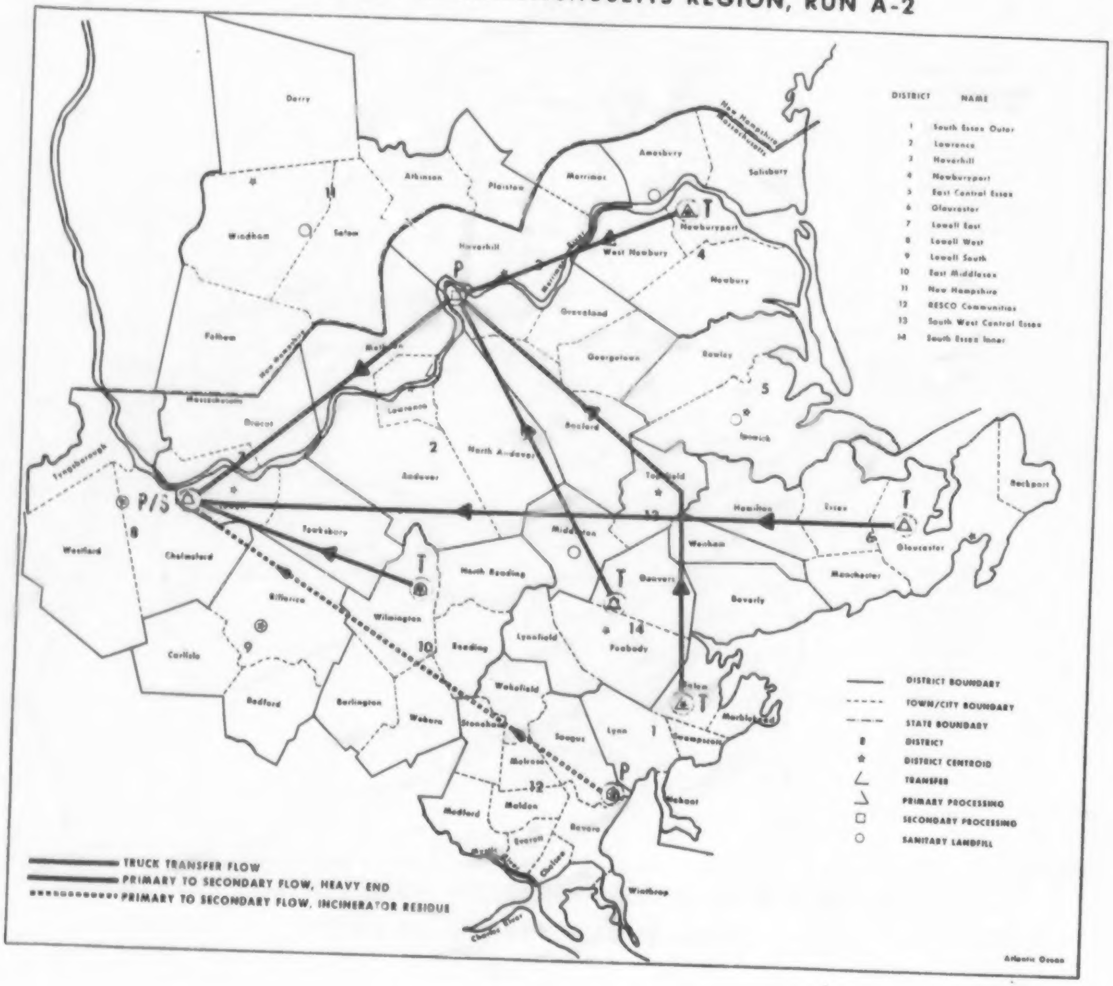
Map 27

FLOWS TO INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN A-2


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
Atlantic Ocean
New Hampshire
Massachusetts
Derry
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
Windham
Haverhill
West Newbury
Newburyport
Newbury
Pelham
Methuen
Groveland
Georgetown
Rowley
Ipswich
Lawrence
Dracut
Tyngsborough
Lowell
Chelmsford
Westford
Tewksbury
Andover
North Andover
Boxford
Topsfield
Hamilton
Essex
Gloucester
Rockport
Wenham
Manchester
Beverly
Middleton
Danvers
Peabody
North Reading
Wilmington
Billerica
Carlisle
Bedford
Burlington
Reading
Lynnfield
Wakefield
Woburn
Stoneham
Saugus
Lynn
Marblehead
Swampscott
Nahant
Melrose
Malden
Medford
Everett
Revere
Chelsea
Winthrop
1
2
3
5
6
7
8
9
10
11
12
13
14

Map 28

FLOWS FROM INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN A-2


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE
New Hampshire
Massachusetts
Derry
Windham
Salem
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
Newburyport
West Newbury
Newbury
Haverhill
Groveland
Georgetown
Rowley
Ipswich
Pelham
Methuen
Dracut
Lawrence
North Andover
Andover
Boxford
Topsfield
Hamilton
Essex
Rockport
Gloucester
Manchester
Wenham
Beverly
Danvers
Middleton
Tyngsborough
Westford
Chelmsford
Tewksbury
Billerica
Wilmington
North Reading
Reading
Lynnfield
Peabody
Salem
Marblehead
Swampscott
Lynn
Saugus
Wakefield
Stoneham
Woburn
Burlington
Carlisle
Bedford
Melrose
Malden
Medford
Everett
Revere
Chelsea
Winthrop
Nahant
Charles River
Atlantic Ocean
P/S
P
T
1
2
4
5
6
8
9
10
11
12
13
14

Run A-3

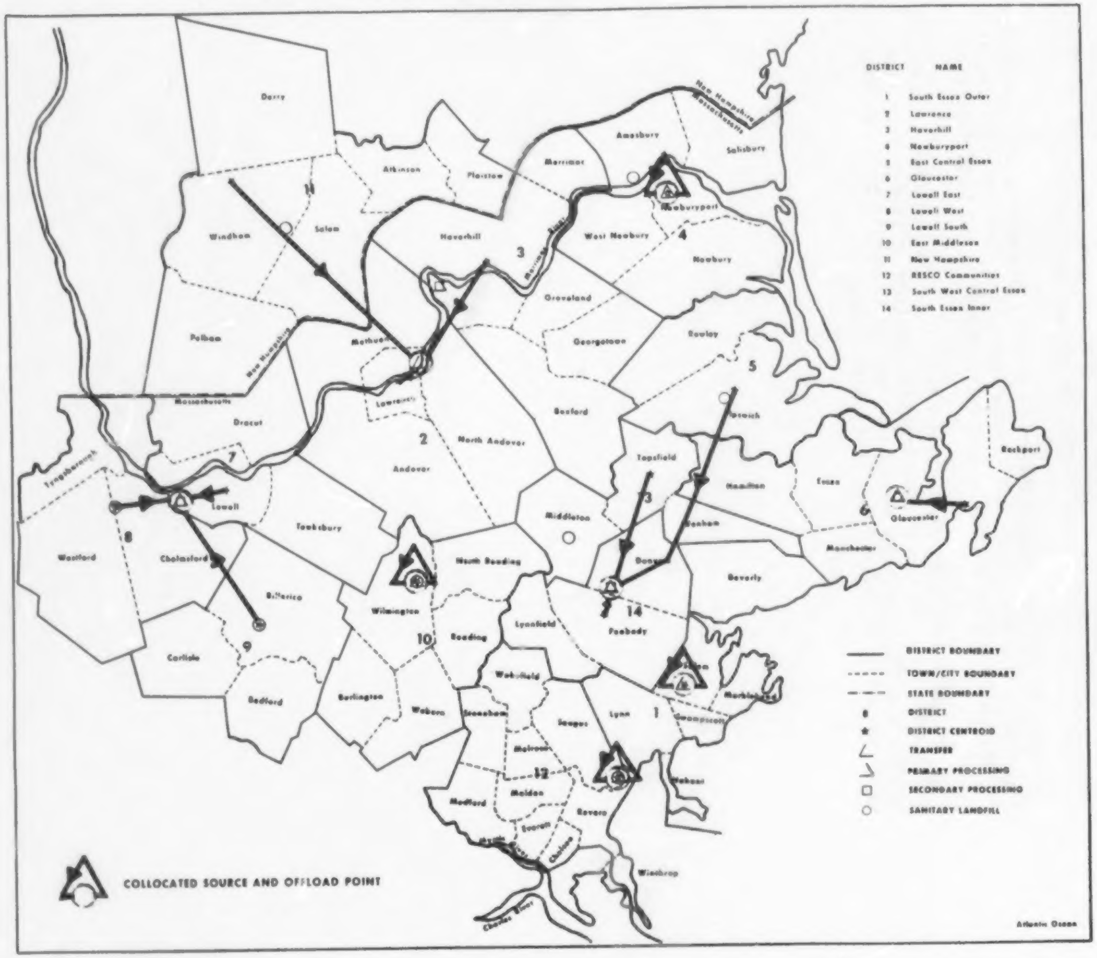
This run was an example of configuration forcing. An advanced starting point was used with all primary processing in South Essex Inner, site 514, except for the forced minimum of 600 TPD at RESCO. A phase 3 solution was obtained with that pattern of primary processing, at a cost slightly preferable to either run A or A-2.

Map 30 displays that pattern of primary processing with secondary processing collocated at South Essex Inner, and transfer stations in Salem, Lawrence, Newburyport, Goucester, Lowell, and East Middlesex.

Map 29 shows flows to initial offload points modified from runs A and A-2 only by the use of the transfer station in Lawrence by Lawrence, Haverhill, and New Hampshire, and by the shift by S. W. Central Essex directly to the primary processing plant.

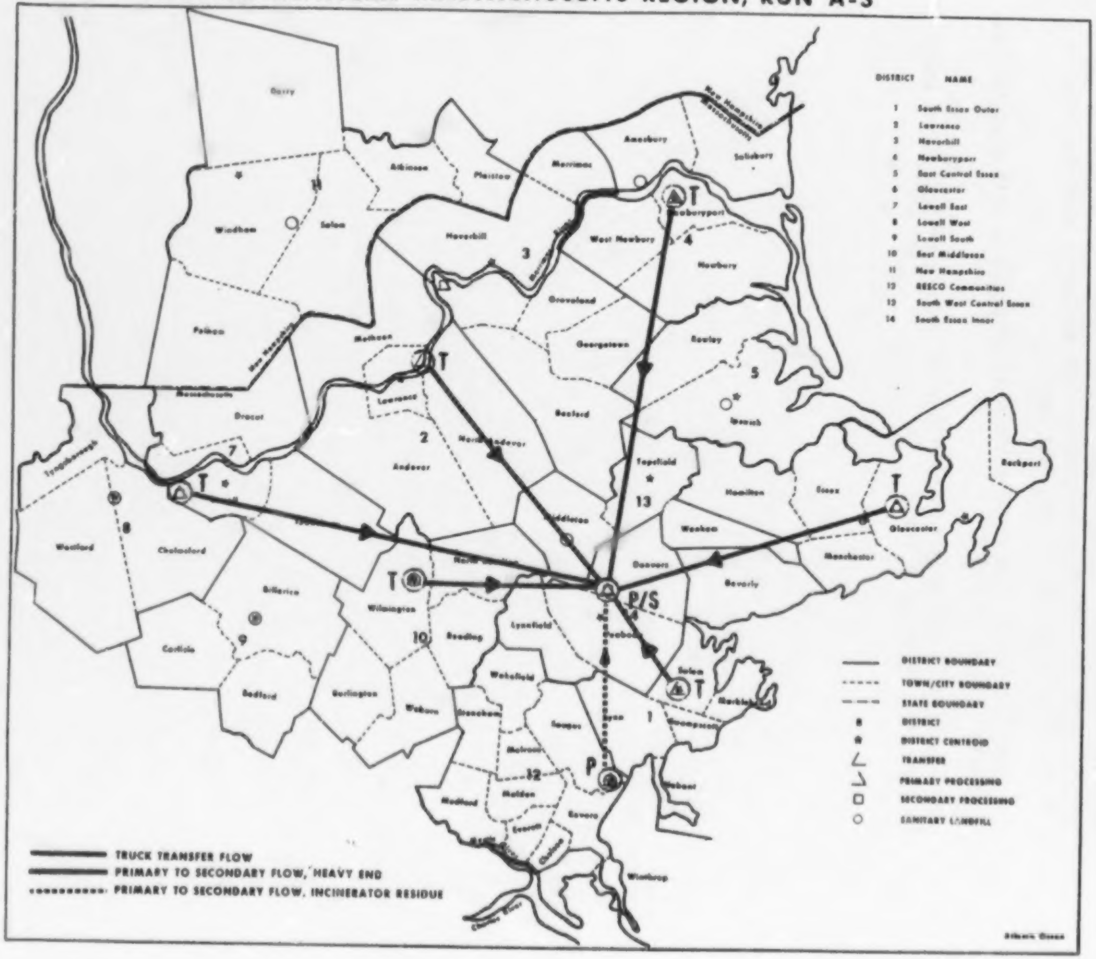
Map 29

FLOWS TO INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN A-3


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
8 DISTRICT
★ DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
□ SECONDARY PROCESSING
○ SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
New Hampshire
Massachusetts
Derry
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
Windham
Salem
Haverhill
Merrimack River
West Newbury
Newburyport
Newbury
Pelham
Methuen
Groveland
Georgetown
Rowley
Dracut
Lawrence
North Andover
Boxford
Ipswich
Tyngsborough
Lowell
Andover
Topsfield
Hamilton
Essex
Rockport
Gloucester
Westford
Chelmsford
Tewksbury
Middleton
Wenham
Manchester
Billerica
North Reading
Danvers
Beverly
Wilmington
Reading
Lynnfield
Peabody
Carlisle
Bedford
Burlington
Woburn
Wakefield
Stoneham
Saugus
Lynn
Salem
Marblehead
Swampscott
Nahant
Melrose
Malden
Medford
Everett
Revere
Chelsea
Mystic River
Charles River
Winthrop
Atlantic Ocean

Map 30

FLOWS FROM INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN A-3


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE
T
P/S
P
New Hampshire
Massachusetts
Derry
Windham
Salem
Pelham
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
Newburyport
West Newbury
Newbury
Haverhill
Groveland
Georgetown
Rowley
Methuen
Lawrence
North Andover
Andover
Boxford
Ipswich
Dracut
Westford
Chelmsford
Topsfield
Hamilton
Essex
Rockport
Gloucester
Wenham
Manchester
Middleton
Danvers
Beverly
Wilmington
Billerica
Carlisle
Bedford
Burlington
Woburn
Reading
Lynnfield
Salem
Marblehead
Swampscott
Wakefield
Stoneham
Saugus
Lynn
Melrose
Malden
Medford
Everett
Revere
Chelsea
Nahant
Winthrop
Atlantic Ocean
1
2
3
4
5
7
8
9
10
11
12
13

Run A-4

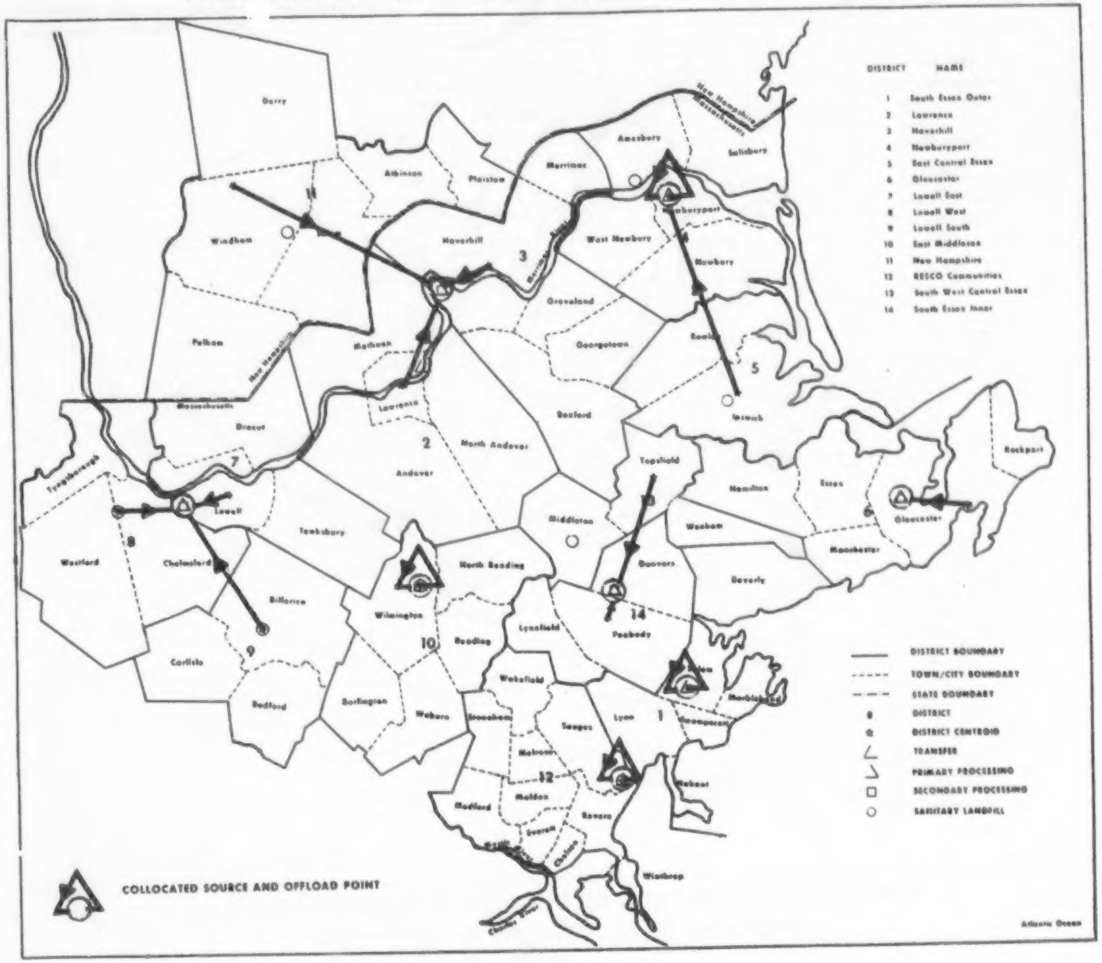
This run was a second example of configuration forcing. An advanced starting point was used with all primary processing in Haverhill, except for the RESCO minimum, and with secondary processing also in Haverhill. A phase 3 solution was obtained with that pattern of processing which proved to be marginally less expensive than run A-3, and was thus identified as the base case.

Map 32 displays the above pattern of processing, with transfer stations selected as in run A.

Map 31 displays a pattern of flows to initial offload point which is identical to those of run A.

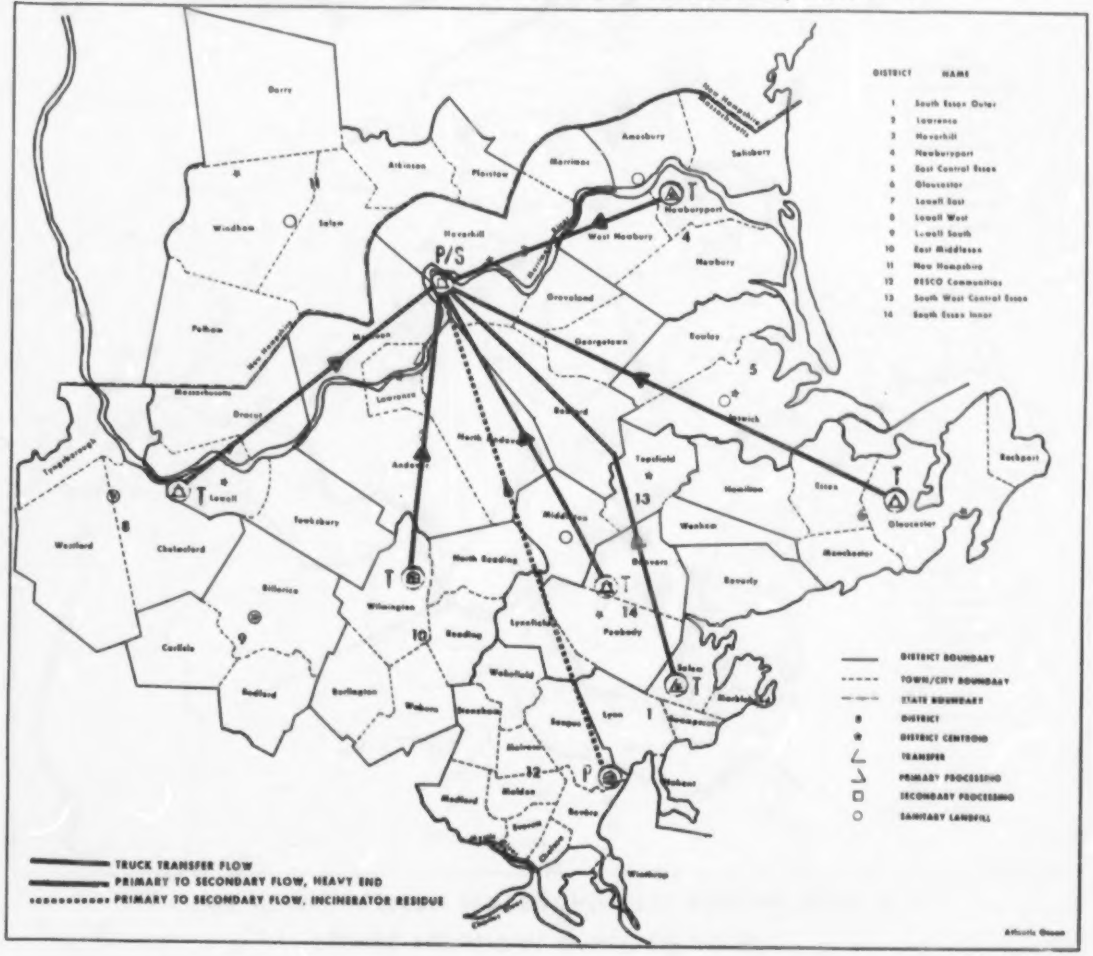
Map 31

FLOWS TO INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN A-4


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
Atlantic Ocean
New Hampshire
Massachusetts
Derry
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
Newburyport
West Newbury
Newbury
Windham
Haverhill
Groveland
Georgetown
Pelham
Methuen
Lawrence
Boxford
Ipswich
Rockport
Dracut
North Andover
Andover
Topsfield
Hamilton
Essex
Gloucester
Tyngsborough
Lowell
Tewksbury
Middleton
Wenham
Manchester
Westford
Chelmsford
North Reading
Danvers
Beverly
Billerica
Wilmington
Peabody
Lynnfield
Reading
Marblehead
Carlisle
Bedford
Burlington
Woburn
Wakefield
Stoneham
Saugus
Lynn
Swampscott
Melrose
Nahant
Malden
Medford
Revere
Everett
Chelsea
Winthrop
1
2
3
5
6
7
8
9
10
11
12
14

Map 32

FLOWS FROM INITIAL OFFLOAD POINT : THE NORTHEASTERN MASSACHUSETTS REGION, RUN A-4



DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE
P/S
T
P
New Hampshire
Massachusetts
Derry
Windham
Salem
Pelham
Atkinson
Plaistow
Haverhill
Merrimac
Amesbury
Salisbury
Newburyport
West Newbury
Newbury
Groveland
Georgetown
Rowley
Ipswich
Methuen
Lawrence
Dracut
Tyngsborough
Lowell
Tewksbury
Andover
North Andover
Boxford
Topsfield
Hamilton
Essex
Gloucester
Rockport
Wenham
Manchester
Beverly
Danvers
Middleton
North Reading
Wilmington
Westford
Chelmsford
Billerica
Carlisle
Bedford
Burlington
Woburn
Reading
Lynnfield
Peabody
Salem
Marblehead
Wakefield
Stoneham
Saugus
Lynn
Swampscott
Nahant
Melrose
Malden
Medford
Everett
Revere
Chelsea
Winthrop
Atlantic Ocean

Reproduced from best available copy.

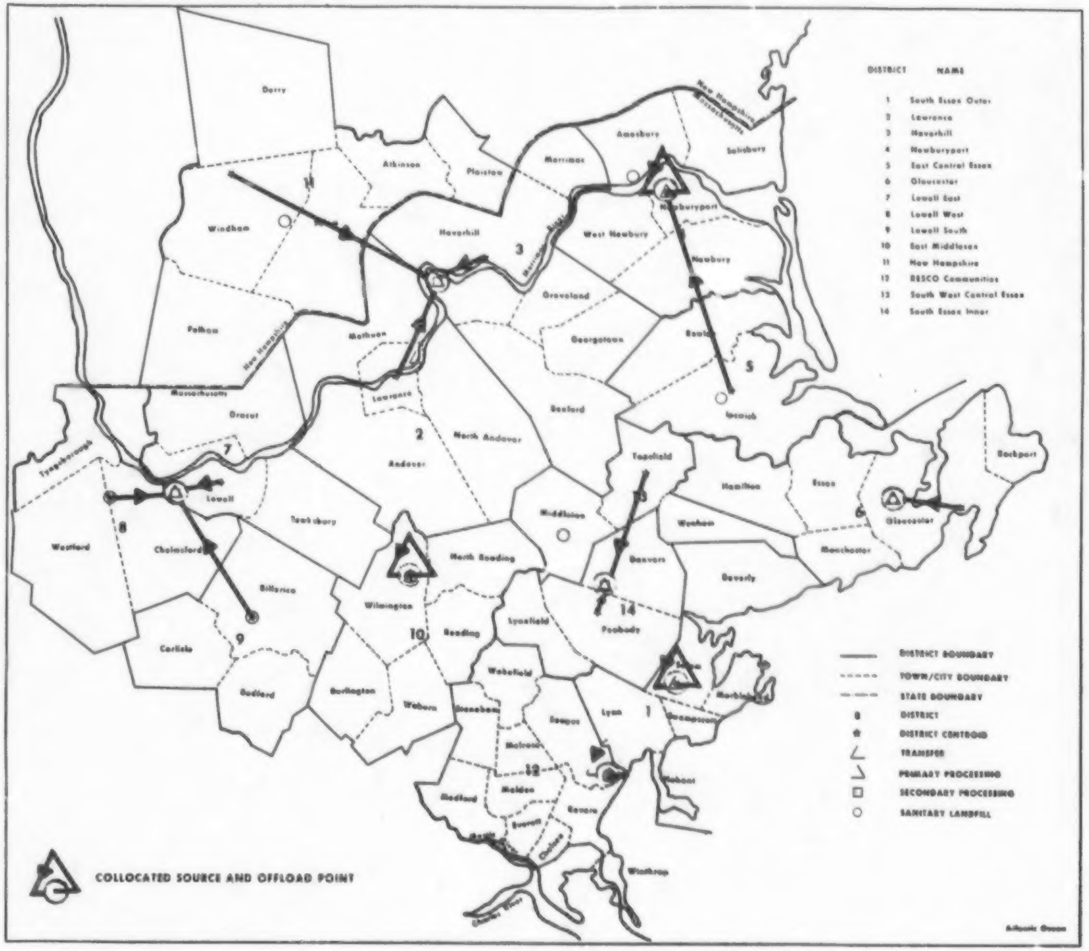
The Tonnage Parameterization

Run B-1

In this run all base case source tonnages were doubled. A phase 4 solution was generated which was structurally identical in all respects to the base case. The solution is displayed in maps 33 and 34.

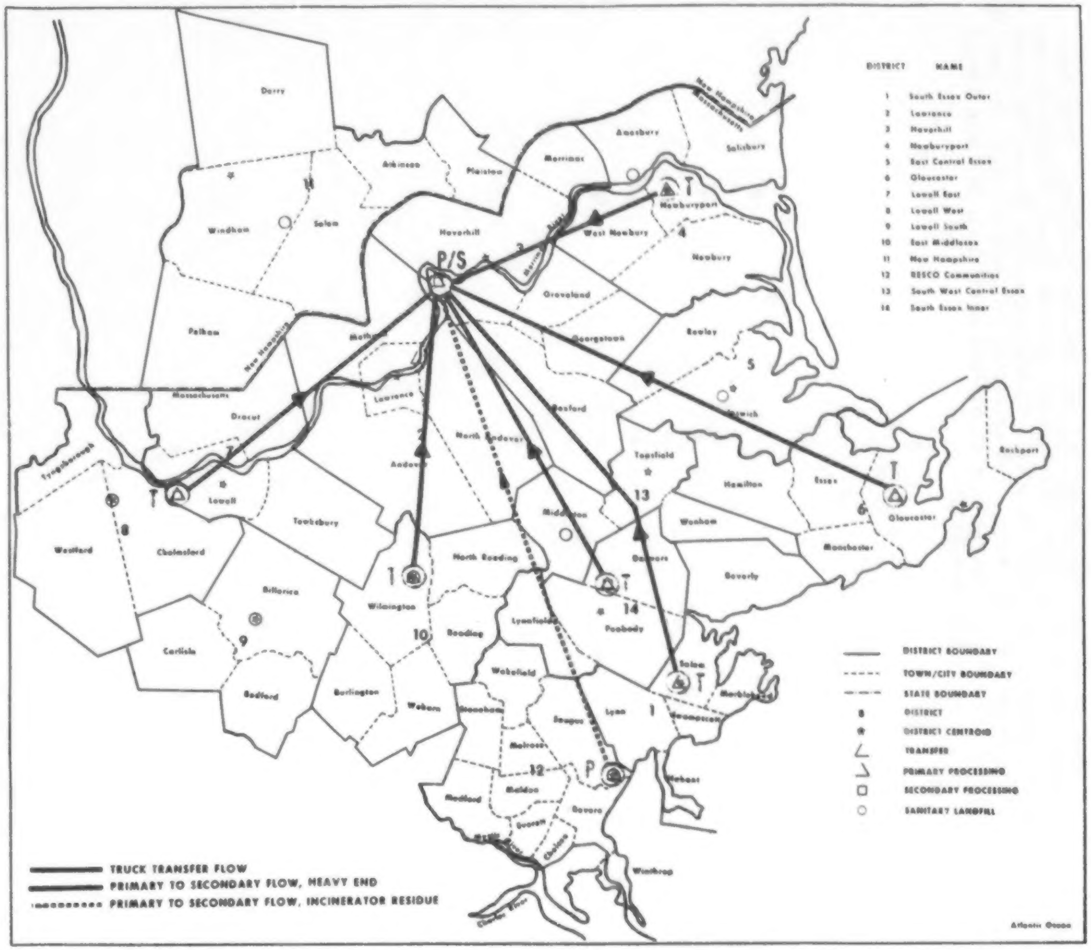
Map 33

FLOWS TO INITIAL OFFLOAD POINT :
THE NORTH EASTERN MASSACHUSETTS REGION, RUN B-1


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
Derry
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
New Hampshire
Massachusetts
Windham
Haverhill
West Newbury
Newburyport
Newbury
Pelham
Methuen
Groveland
Georgetown
Rowley
Ipswich
Dracut
Lawrence
North Andover
Andover
Boxford
Topsfield
Hamilton
Essex
Rockport
Gloucester
Manchester
Wenham
Beverly
Danvers
Middleton
Tyngsborough
Lowell
Tewksbury
Westford
Chelmsford
Billerica
Wilmington
North Reading
Lynnfield
Peabody
Salem
Marblehead
Swampscott
Lynn
Saugus
Nahant
Carlisle
Bedford
Burlington
Reading
Wakefield
Woburn
Stoneham
Melrose
Malden
Medford
Everett
Revere
Chelsea
Winthrop
Charles River
Mystic River
Merrimack River
Atlantic Ocean
1
2
3
5
6
7
8
9
10
11
12
13
14

Map 34

FLOWS FROM INITIAL OFFLOAD POINT : THE NORTH EASTERN MASSACHUSETTS REGION, RUN B-1


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE
P/S
T
P
Derry
Windham
Salem
Pelham
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
Haverhill
Newburyport
West Newbury
Newbury
Groveland
Georgetown
Rowley
Ipswich
Rockport
Gloucester
Essex
Hamilton
Manchester
Wenham
Beverly
Topsfield
Boxford
North Andover
Andover
Lawrence
Methuen
Dracut
Lowell
Tyngsborough
Tewksbury
Chelmsford
Westford
Billerica
Carlisle
Bedford
Burlington
Wilmington
North Reading
Reading
Woburn
Middleton
Danvers
Peabody
Lynnfield
Wakefield
Stoneham
Saugus
Lynn
Swampscott
Salem
Marblehead
Nahant
Melrose
Malden
Medford
Everett
Revere
Chelsea
Winthrop
Massachusetts
New Hampshire
Charles River
Atlantic Ocean

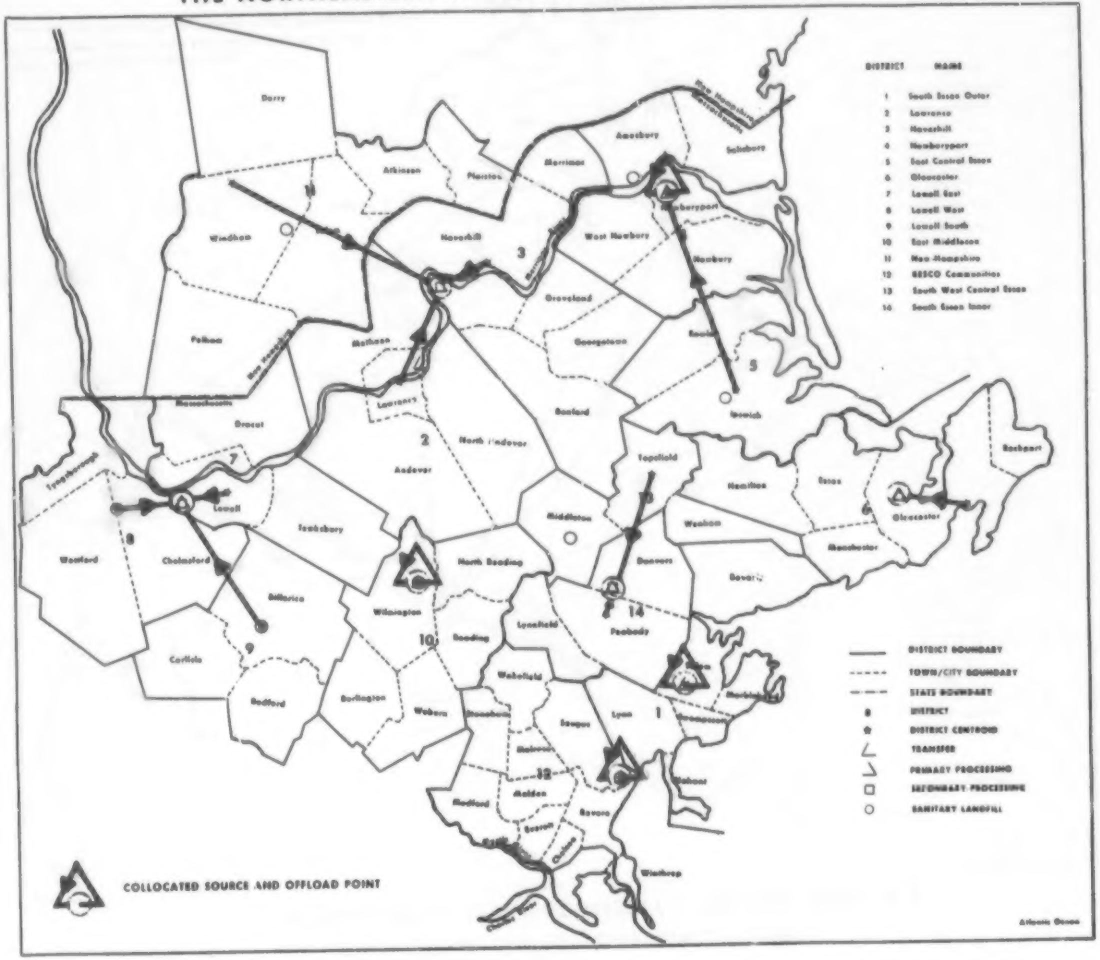
Run B-2

In this run, all base case source tonnages were halved; and a phase 4 solution was obtained.

Map 36 displays the processing and transfer solution. Note that secondary processing, with less haulage costs at issue, because of reduced tonnages, was moved to Lowell to take advantage of the EPA grant available only at that site. The selection of transfer stations (map 36) and the pattern of flows to initial offload point (map 35) were identical to those of the base case.

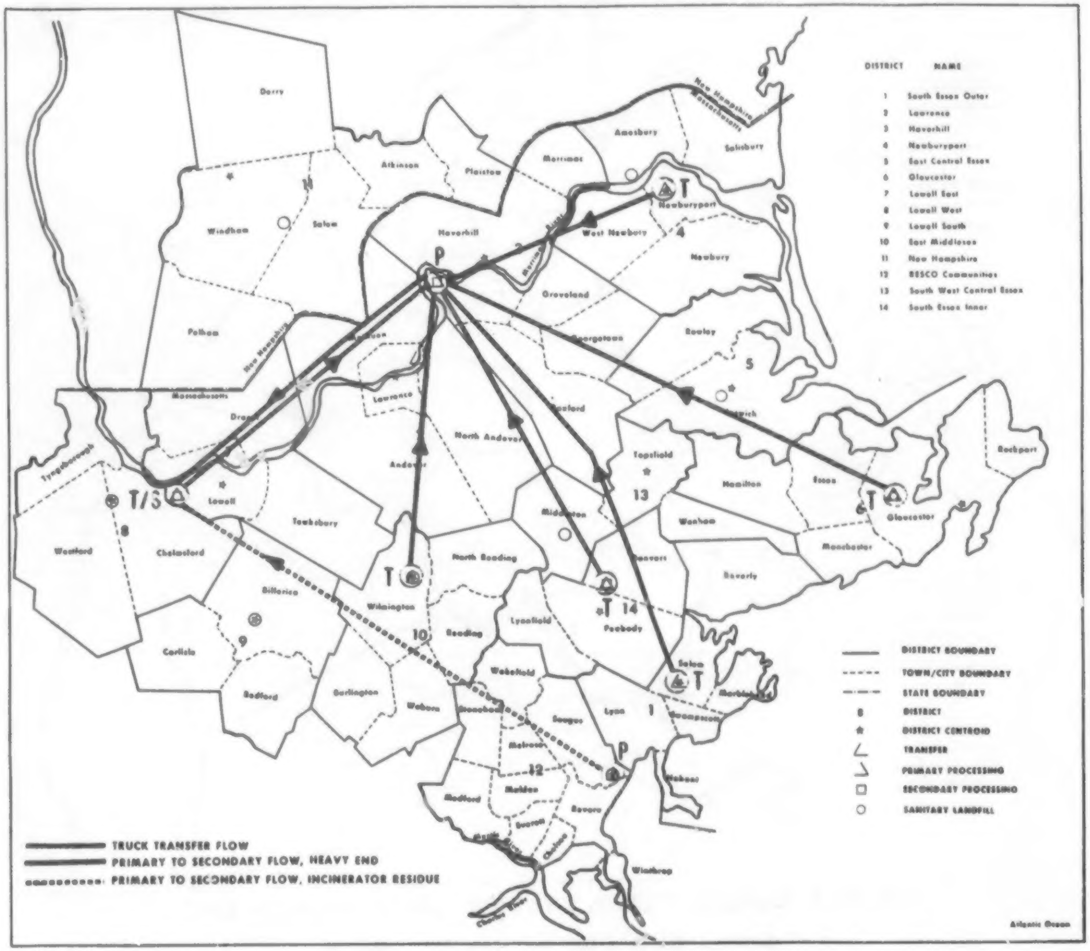
Map 35

FLOWS TO INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN B-2


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
Derry
Windham
Pelham
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
Haverhill
West Newbury
Newburyport
Newbury
Groveland
Georgetown
Methuen
Lawrence
North Andover
Andover
Boxford
Ipswich
Topsfield
Hamilton
Essex
Gloucester
Rockport
Manchester
Wenham
Beverly
Danvers
Middleton
Peabody
Lynnfield
Dracut
Tyngsborough
Lowell
Westford
Chelmsford
Tewksbury
Billerica
Carlisle
Bedford
Wilmington
North Reading
Reading
Burlington
Woburn
Stoneham
Wakefield
Saugus
Lynn
Marblehead
Swampscott
Nahant
Melrose
Malden
Medford
Everett
Revere
Chelsea
Winthrop
Atlantic Ocean

Map 36

FLOWS FROM INITIAL OFFLOAD POINT : THE NORTHEASTERN MASSACHUSETTS REGION, RUN B-2


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE
Derry
Windham
Salem
Pelham
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
New Hampshire
Massachusetts
Newburyport
West Newbury
Newbury
Haverhill
Groveland
Georgetown
Rowley
Lawrence
North Andover
Andover
Topsfield
Hamilton
Essex
Gloucester
Rockport
Wenham
Manchester
Beverly
Danvers
Peabody
Salem
Marblehead
Swampscott
Lynn
Nahant
Saugus
Lynnfield
Wakefield
Melrose
Malden
Medford
Everett
Revere
Chelsea
Winthrop
Charles River
Tyngsborough
Lowell
Tewksbury
Westford
Chelmsford
Billerica
Carlisle
Bedford
Burlington
Woburn
Wilmington
North Reading
Reading
Atlantic Ocean
P
T
T/S
1
4
5
6
8
9
10
11
12
13
14

The CROW-FLY (Region Size) Parameterization

In the CROW-FLY parameterization, transportation distances were generated from longitude and latitude coordinates using flat-earth straight-line measurements. Transportation times were then generated from these measurements and an average speed assumption. A 45 mph speed was used in run C-1 to represent a small region (as compared to the base case); a 20 mph speed was used in run C-2 to represent a medium sized region; and a 10 mph speed was used in run C-3 to represent a large region. All three of the runs were operated through phase 4.

Run C-1: 45 mph speed (small region)

Map 38 shows a solution in which secondary processing was moved to Lowell. The smaller region size reduced haul costs, relative to the base case, and thus made the EPA grant, available only in Lowell, more attractive. In addition, the transfer station at Newburyport was dropped.

Map 37 shows some changes relative to the base case which resulted from the smaller region size. Thus Newburyport and E. Central Essex shipped directly to Haverhill in lieu of the Newburyport transfer station; and S. W. Central Essex shipped directly to Haverhill in lieu of the South Essex Inner transfer station.

The CROW-FLY (Region Size) Parameterization

In the CROW-FLY parameterization, transportation distances were generated from longitude and latitude coordinates using flat-earth straight-line measurements. Transportation times were then generated from these measurements and an average speed assumption. A 45 mph speed was used in run C-1 to represent a small region (as compared to the base case); a 20 mph speed was used in run C-2 to represent a medium sized region; and a 10 mph speed was used in run C-3 to represent a large region. All three of the runs were operated through phase 4.

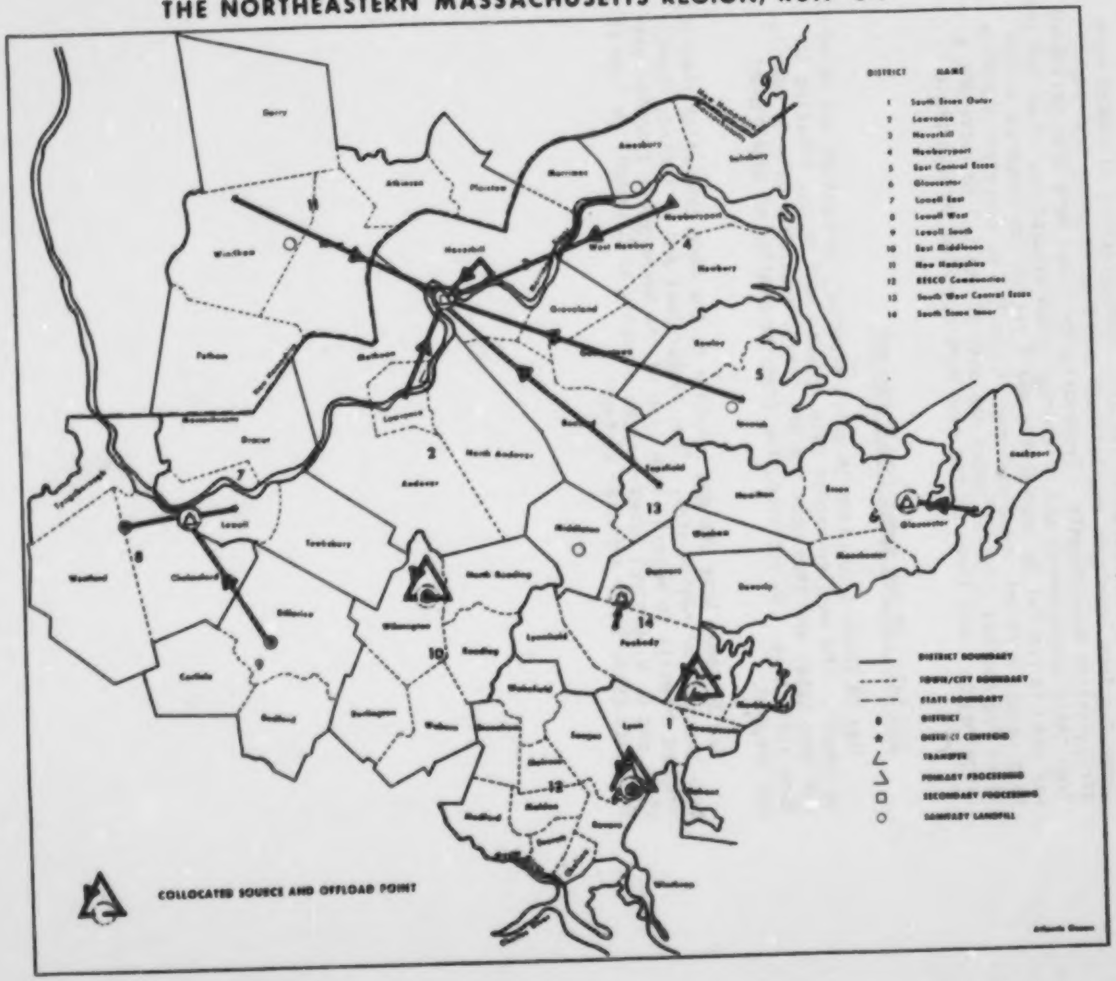
Run C-1: 45 mph speed (small region)

Map 38 shows a solution in which secondary processing was moved to Lowell. The smaller region size reduced haul costs, relative to the base case, and thus made the EPA grant, available only in Lowell, more attractive. In addition, the transfer station at Newburyport was dropped.

Map 37 shows some changes relative to the base case which resulted from the smaller region size. Thus Newburyport and E. Central Essex shipped directly to Haverhill in lieu of the Newburyport transfer station; and S. W. Central Essex shipped directly to Haverhill in lieu of the South Essex Inner transfer station.

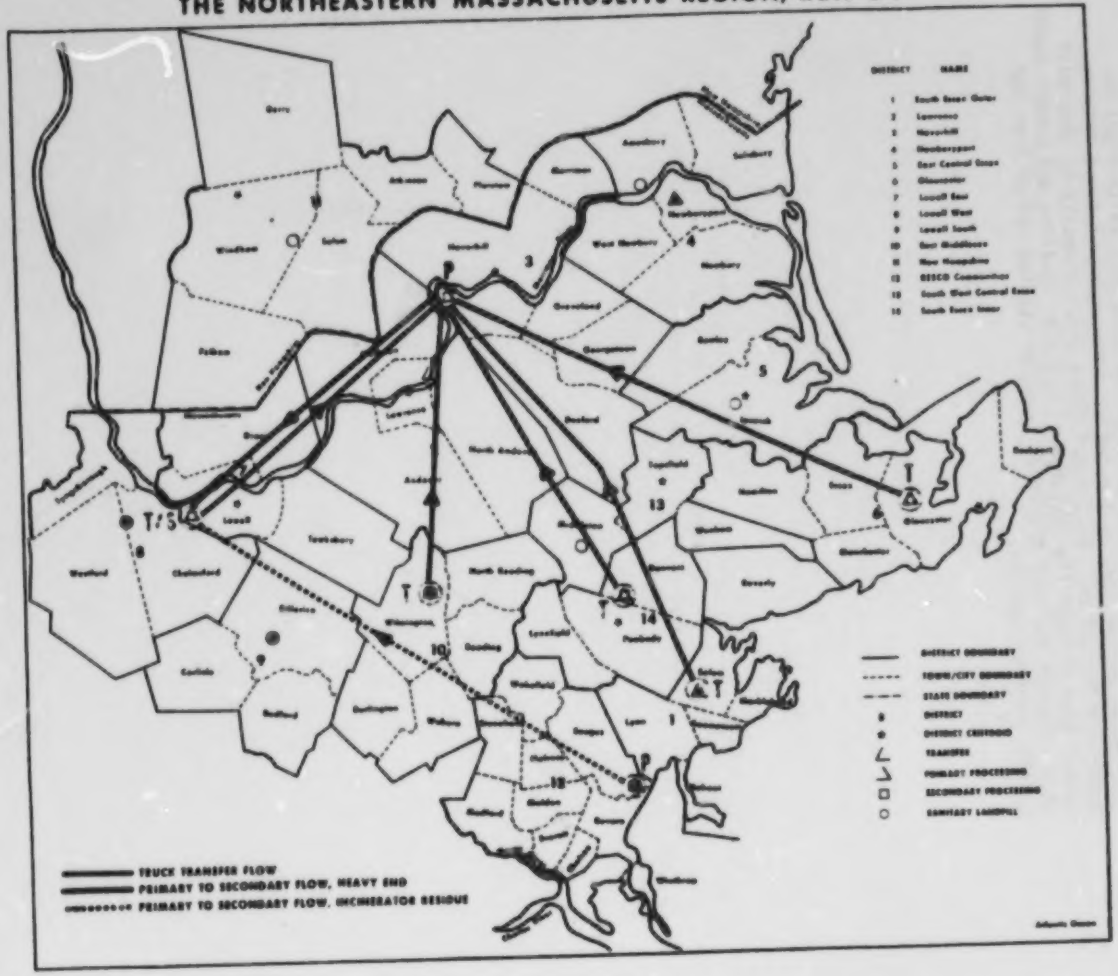
Map 37

FLOWS TO INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN C-1


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
Derry
Windham
Salem
Pelham
Atkinson
Plaistow
Haverhill
Merrimac
Amesbury
Salisbury
Newburyport
West Newbury
Newbury
Groveland
Georgetown
Rowley
Ipswich
Methuen
Lawrence
North Andover
Andover
Boxford
Topsfield
Middleton
Hamilton
Wenham
Essex
Gloucester
Rockport
Manchester
Beverly
Danvers
Peabody
Lynnfield
North Reading
Reading
Wilmington
Tewksbury
Dracut
Lowell
Chelmsford
Westford
Tyngsborough
Billerica
Carlisle
Bedford
Burlington
Woburn
Wakefield
Saugus
Lynn
Marblehead
Medford
Malden
Everett
Winthrop
Atlantic Ocean
1
2
4
5
6
7
8
9
10
11
12
13
14

Map 38

FLOWS FROM INITIAL OFFLOAD POINT : THE NORTHEASTERN MASSACHUSETTS REGION, RUN C-1


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE
T/S
T
P
Derry
Haverhill
Lowell
Gloucester

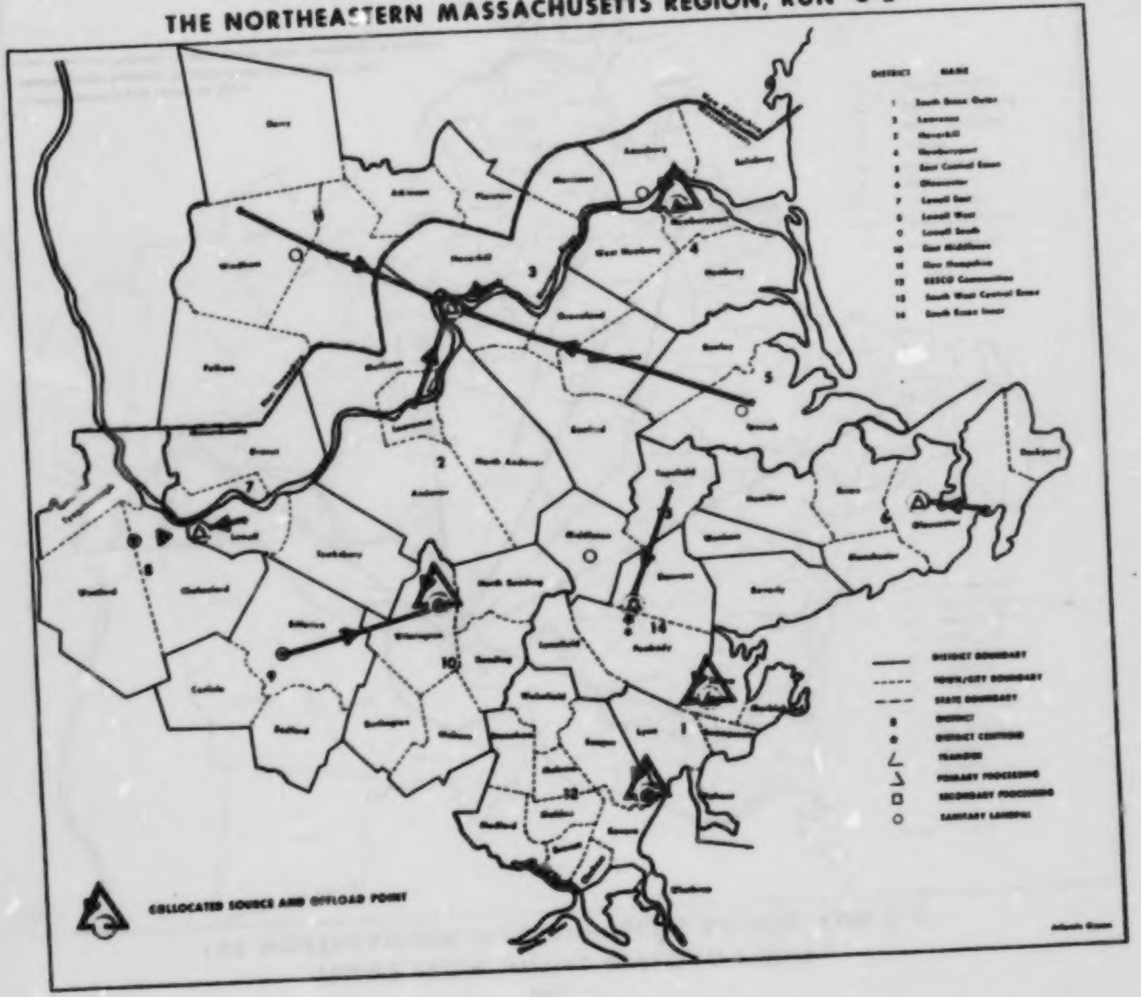
Run C-2: 20 mph (medium region)

Map 40 shows a solution which is identical to the base case.

Map 39 shows some changes from the base case which might be considered reflections on the poorer measurement of times between points in the system. E. Central Essex ships directly to Haverhill rather than through the Newburyport transfer station, and Lowell South ships through the East Middlesex transfer station rather than the Lowell transfer station.

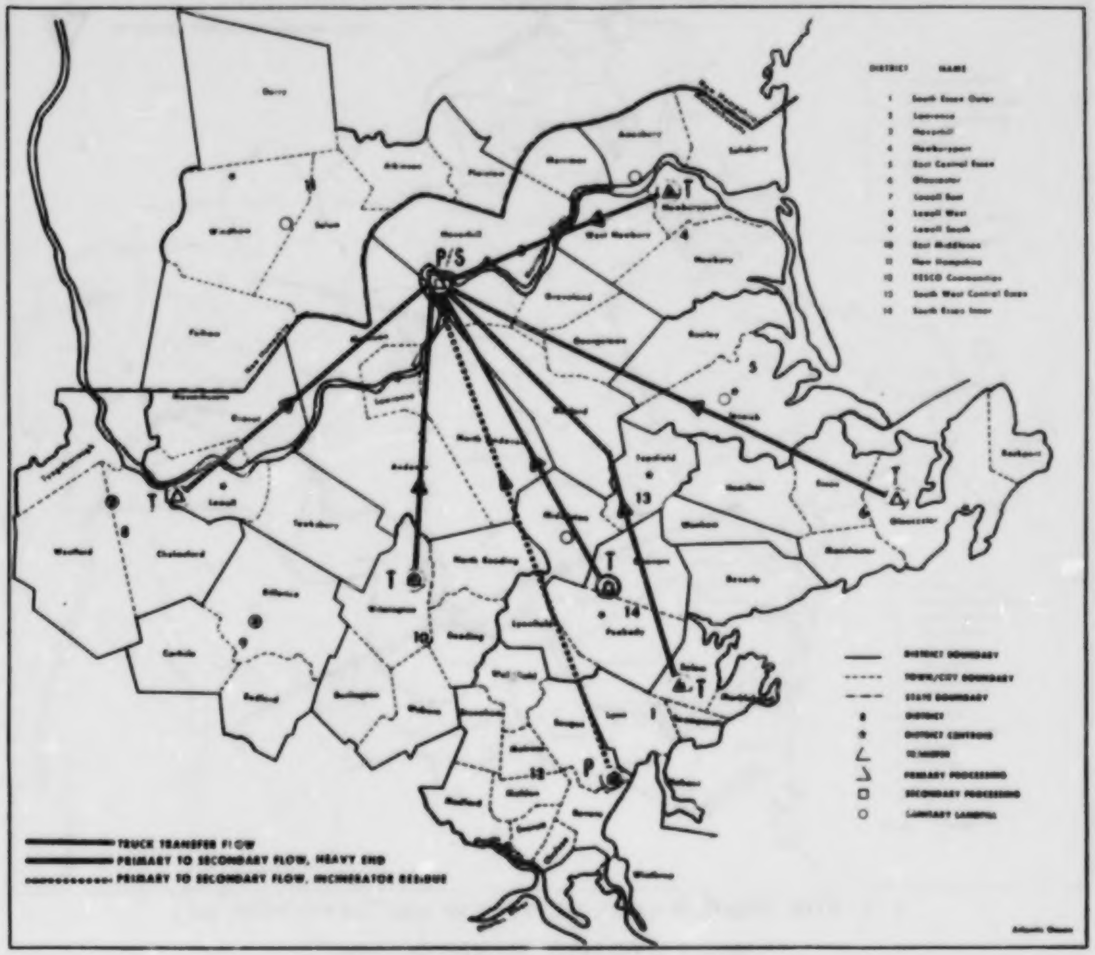
Map 39

FLOWS TO INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN C-2


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
Atlantic Ocean
1
2
3
4
5
6
7
8
9
10
12
14

Map 40

FLOWS FROM INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN C-2


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE
P/S
T
P
Atlantic Ocean

Run C-3: 10 mph (large region)

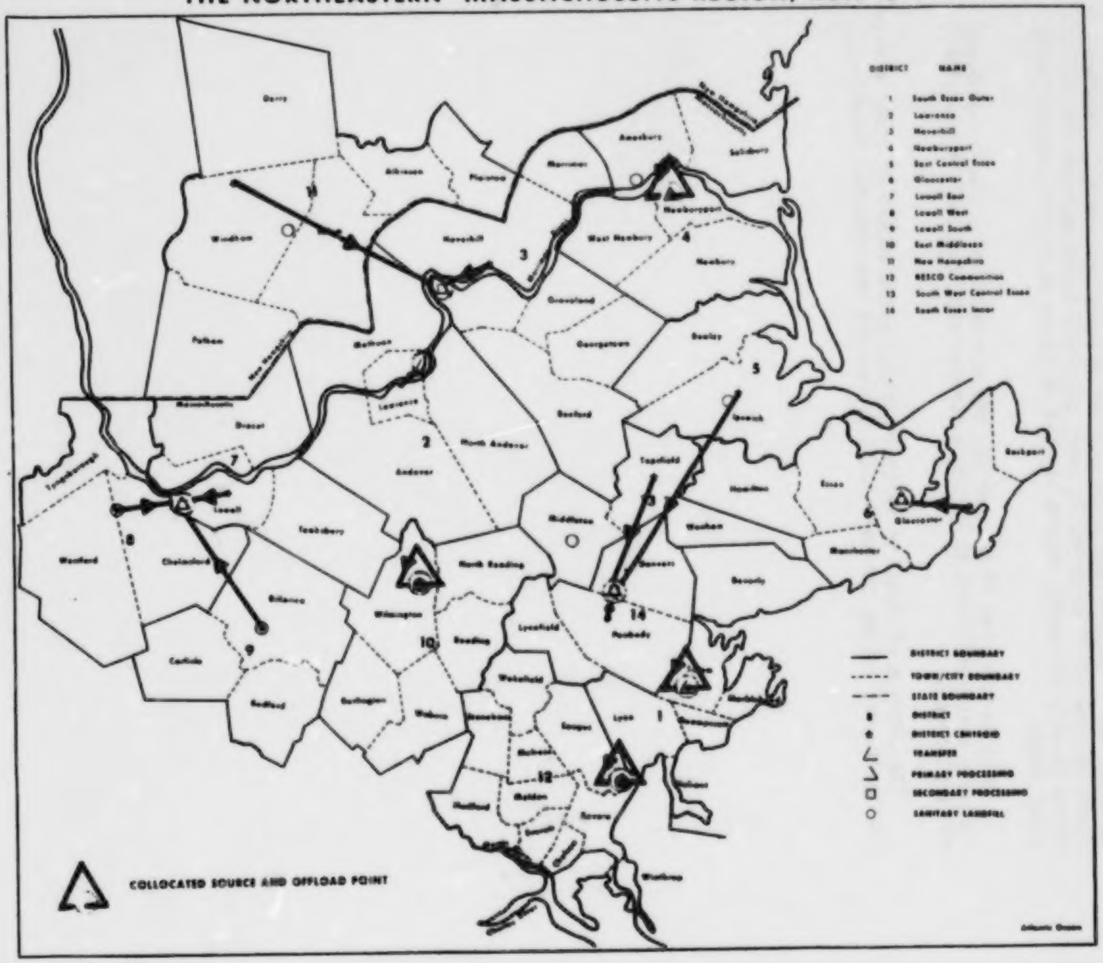
The 10 mph speed in run C-3 generated a decentralized processing pattern in the region. Map 42 shows that primary processing (using the shredded fuel process) was selected at Haverhill, Lowell, and South Essex Inner; and RESCO continues at its forced minimum level of 600 tons per day. Despite the dispersion of primary processing, transfer stations were still selected at every possible location, even in Lawrence to ship to nearby Haverhill, and at Salem to ship to nearby South Essex Inner.

Despite the size of the region, the economies of scale in secondary recovery were sufficient to retain a centralized location (in Haverhill) for that process.

The pattern of flows to initial offload point in map 41 shows shorter distances, reflecting the additional processing and transfer locations.

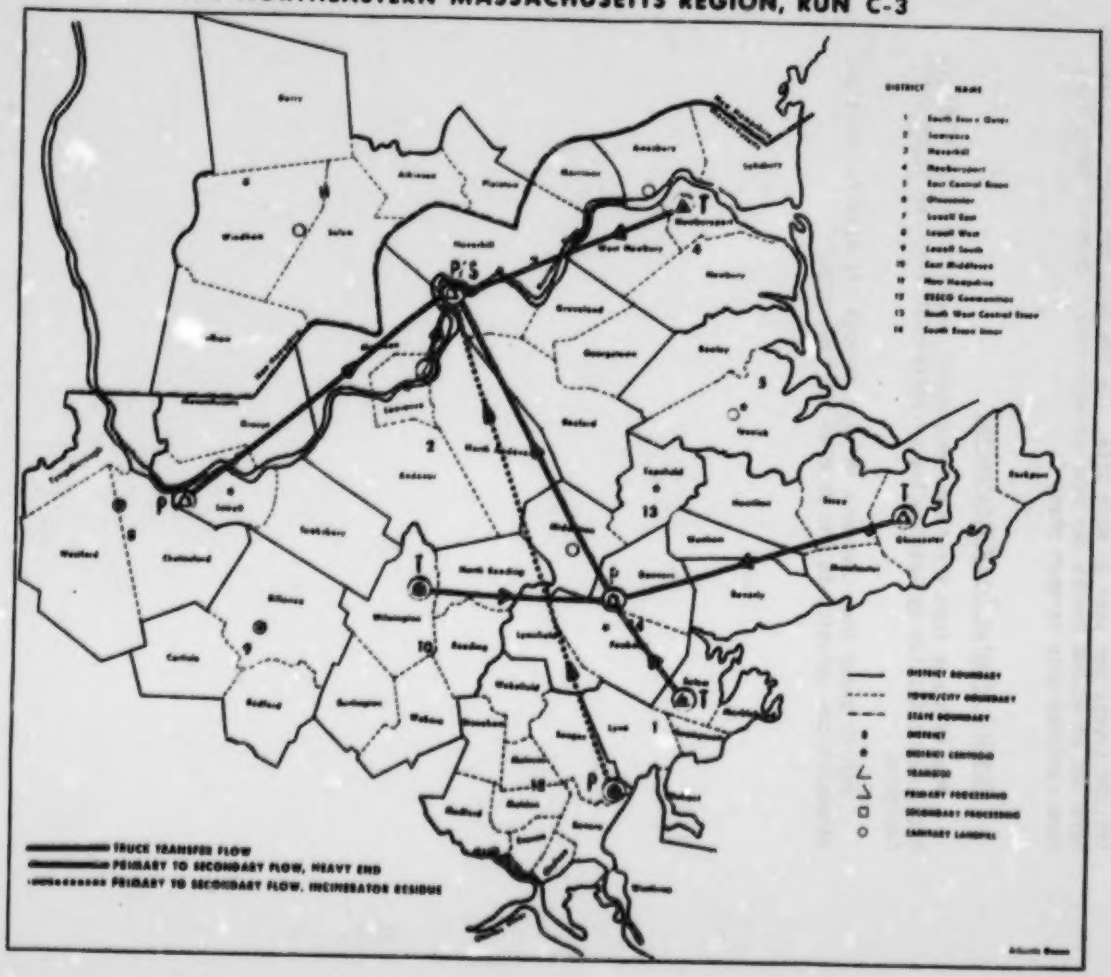
Map 41

FLOWS TO INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN C-3


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
Derry
Windham
Pelham
Haverhill
Amesbury
Salisbury
Newburyport
West Newbury
Newbury
Groveland
Georgetown
Methuen
Lawrence
Dracut
North Andover
Andover
Boxford
Ipswich
Topsfield
Middleton
Lowell
Tewksbury
Westford
Chelmsford
Billerica
Carlisle
Bedford
Wilmington
North Reading
Reading
Lynnfield
Peabody
Danvers
Wenham
Hamilton
Essex
Gloucester
Rockport
Manchester
Beverly
Lynn
Saugus
Malden
Revere
Atlantic Ocean

Map 42

FLOWS FROM INITIAL OFFLOAD POINT : THE NORTHEASTERN MASSACHUSETTS REGION, RUN C-3


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE
P/S
P
T
Derry
Haverhill
Newburyport
Andover
Gloucester
Lowell
Salem
Atlantic Ocean

The Truck Constraint Parameterization

Maximum truck constraints were imposed on Haverhill, Lowell, and South Essex Inner. In run D-1, the truck constraints were set at 105,000 trucks per year at each site. In run D-2, the truck constraints were set at 40,000 trucks per year at each site. Both of these runs were operated only through phase 3.

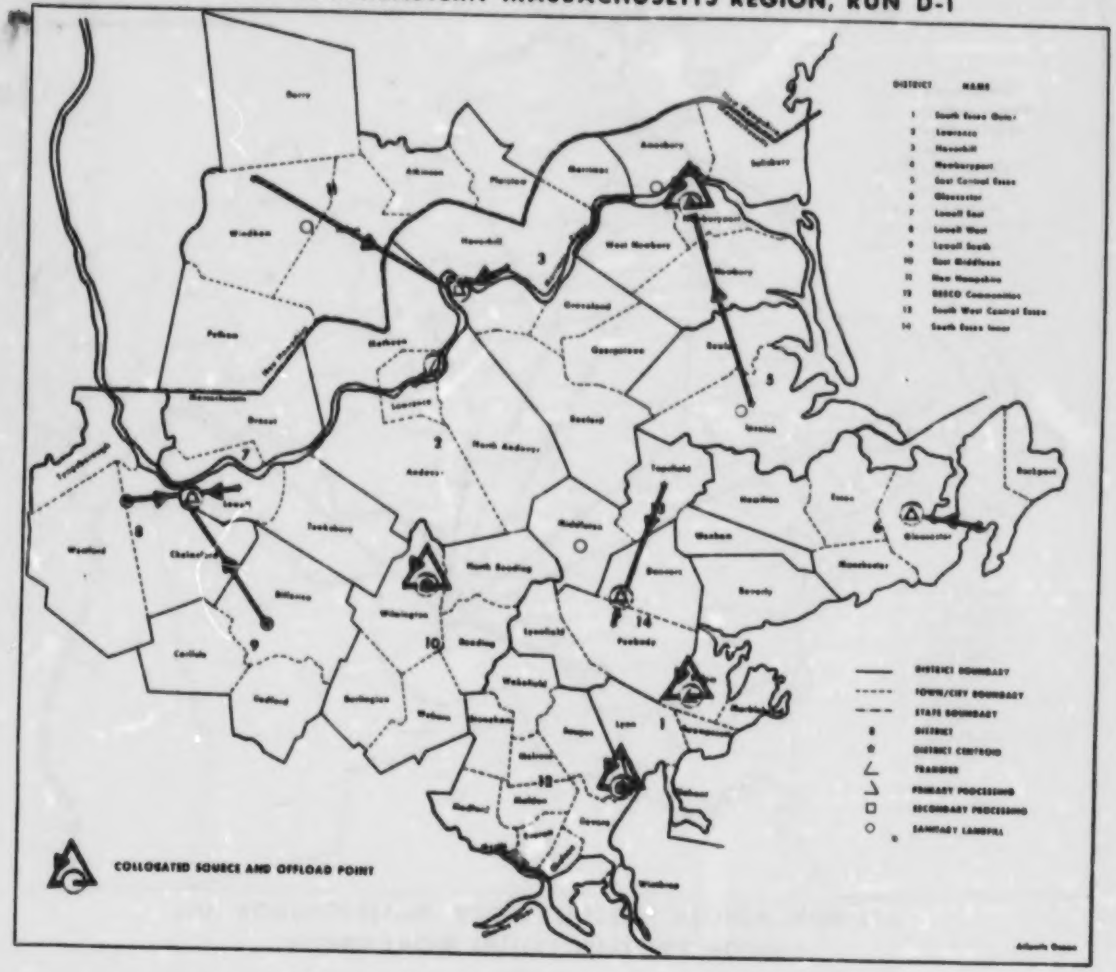
Run D-1 (Medium Truck Constraint)

Map 44 shows that the truck constraint, operative only at Haverhill, was satisfied by introducing an additional transfer station in Lawrence.

Map 43 shows that Lawrence shipped through its transfer station; otherwise the solution is the same as the base case.

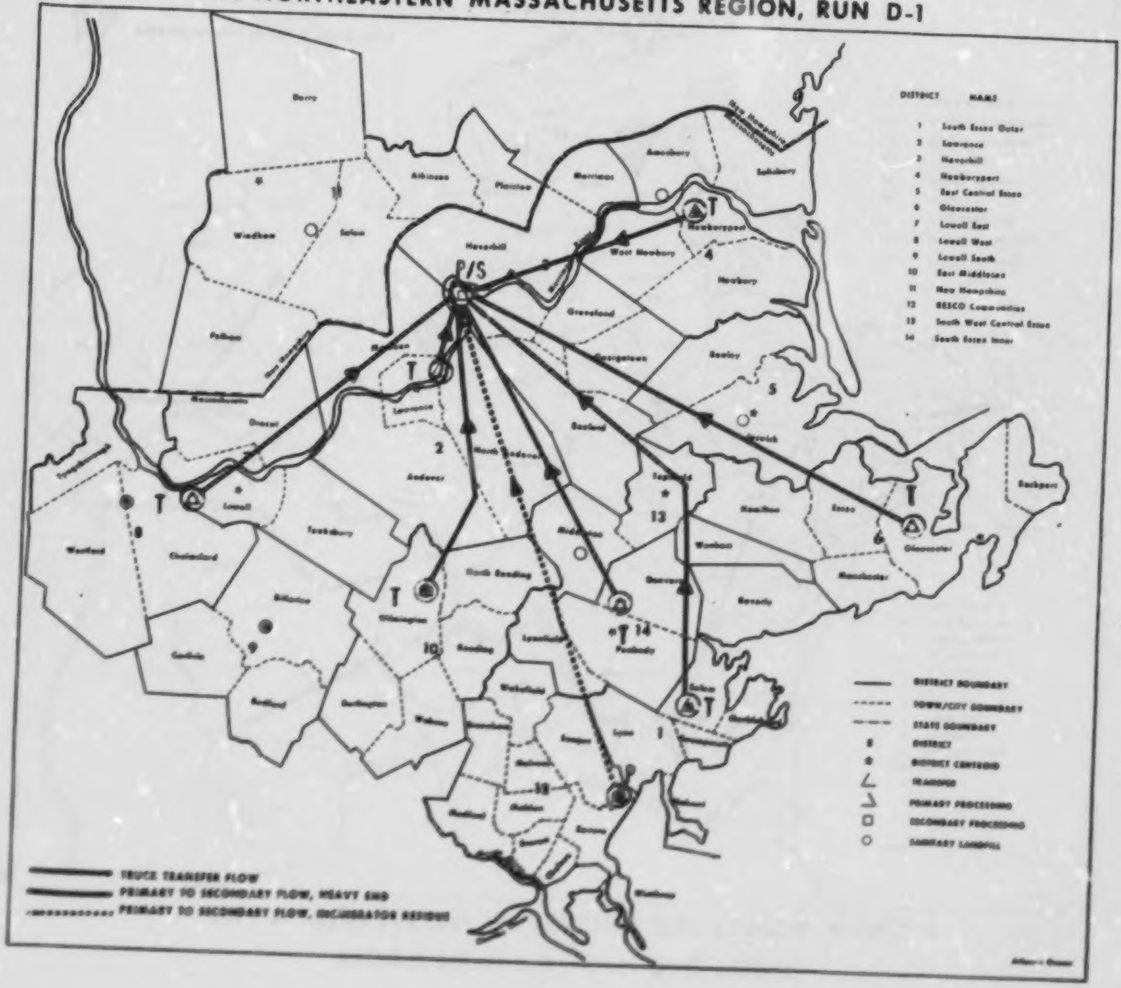
Map 43

FLOWS TO INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN D-1


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
Atlantic Ocean

Map 44

FLOWS FROM INITIAL OFFLOAD POINT : THE NORTHEASTERN MASSACHUSETTS REGION, RUN D-1


P/S
T
New Hampshire
Massachusetts
Derry
Windham
Salem
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
Pelham
Haverhill
Methuen
Lawrence
Dracut
Lowell
Westford
Chelmsford
Tewksbury
Andover
North Andover
Billerica
Carlisle
Bedford
Burlington
Wilmington
North Reading
Reading
Woburn
Wakefield
Lynnfield
Middleton
Peabody
Danvers
Topsfield
Boxford
Georgetown
Groveland
West Newbury
Newburyport
Newbury
Rowley
Ipswich
Hamilton
Wenham
Essex
Gloucester
Rockport
Manchester
Beverly
Lynn
Saugus
1
2
4
5
6
8
9
10
11
13
14
DISTRICT
NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE

Run D-2 (Tight Truck Constraint)

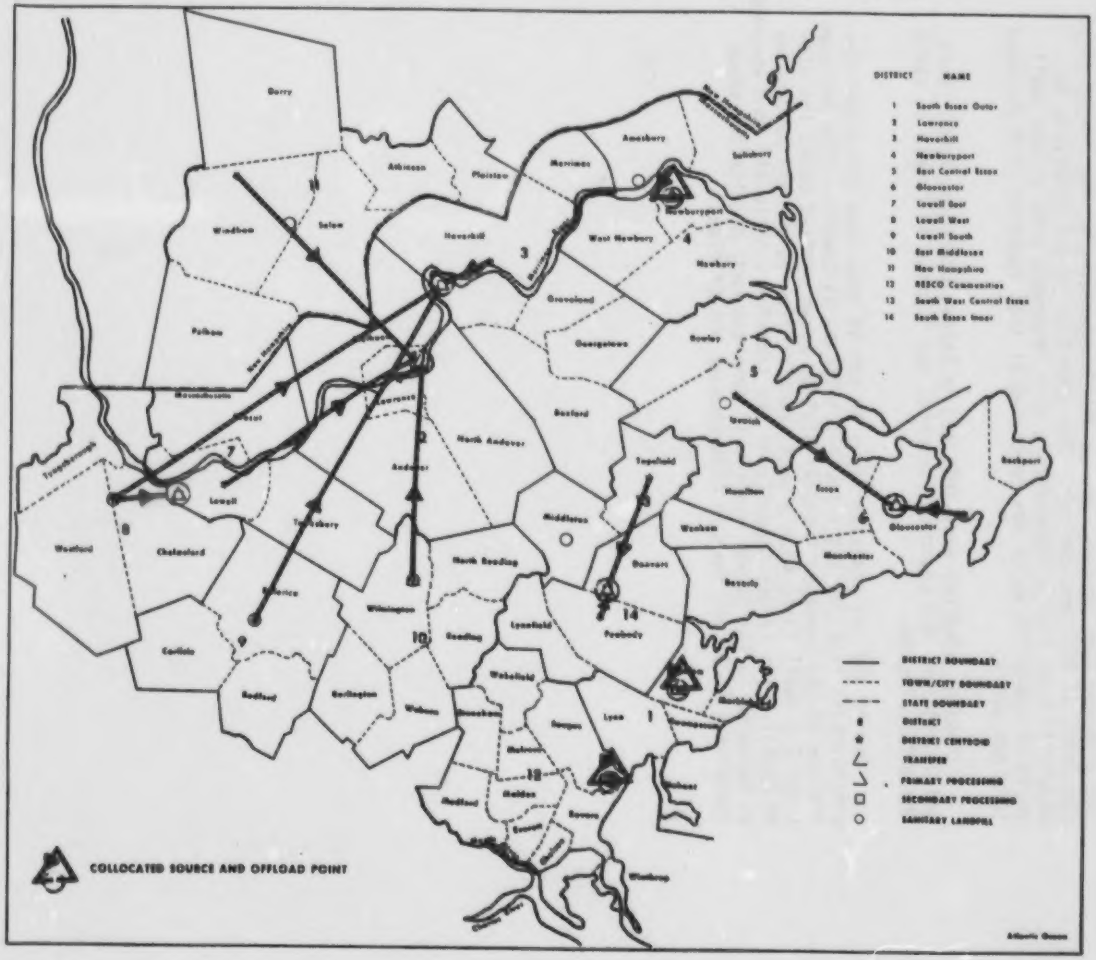
Map 46 reveals a decentralized pattern of production. Primary processing was selected at Haverhill, using the gas pyrolysis process; at Lowell, using the shredded fuel process; at South Essex Inner, using the shredded fuel process; and at RESCO, operating at the forced minimum level of 600 tons per day. The selection of gas pyrolysis at Haverhill most likely represents a more favorable cost at the small scale of operation which was generated at that location (113 thousand tons per year).

Transfer stations were selected in Salem, Lawrence, Newburyport, and Gloucester, and secondary recovery was located in Lowell to serve the entire region.

Map 45 and the transfer flows in map 46 show some irregularities which result from the tight truck constraint at Lowell. This includes the use of the Lawrence transfer station as an offload point for district 7 (Lowell East) with a back transfer flow to primary processing in Lowell. The larger capacity of the transfer vehicle (17 tons assumed) as compared to the packer vehicle (5 tons assumed) permits the truck constraint to be met through this unusual set of flows.

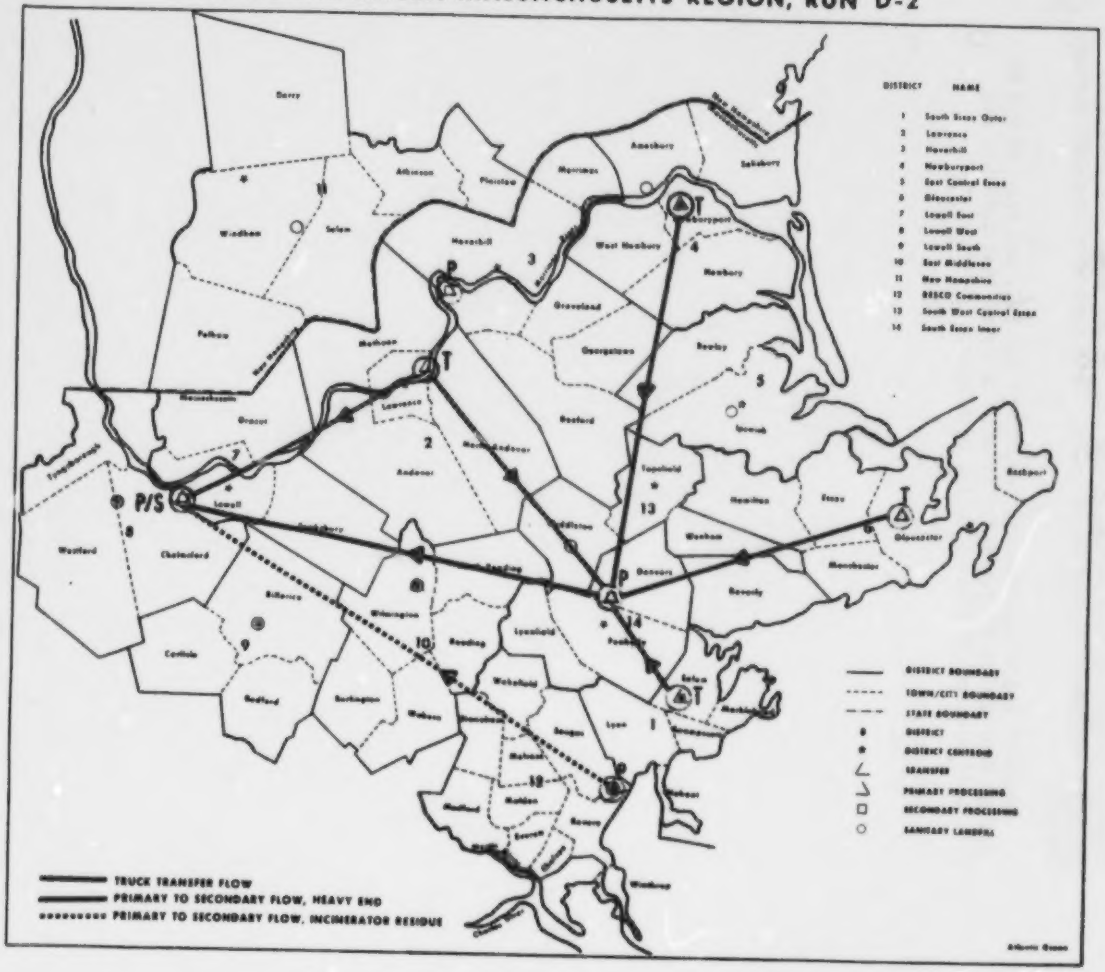
Map 45

FLOWS TO INITIAL OFFLOAD POINT : THE NORTHEASTERN MASSACHUSETTS REGION, RUN D-2


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
Derry
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
Windham
Salem
Haverhill
West Newbury
Newburyport
Newbury
Pelham
Groveland
Georgetown
Rowley
Ipswich
Boxford
North Andover
Andover
Lawrence
Methuen
Dracut
Lowell
Tewksbury
Westford
Chelmsford
Billerica
Carlisle
Bedford
Burlington
Wilmington
North Reading
Reading
Woburn
Lynnfield
Middleton
Topsfield
Danvers
Peabody
Hamilton
Wenham
Essex
Manchester
Beverly
Gloucester
Rockport
Wakefield
Saugus
Lynn
Melrose
Malden
Medford
Revere
Winthrop
Atlantic Ocean
1
2
3
4
5
6
7
8
9
10
11
12
14

Map 46

FLOWS FROM INITIAL OFFLOAD POINT : THE NORTHEASTERN MASSACHUSETTS REGION, RUN D-2


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE
P/S
T
P
Derry
Atkinson
Plaistow
Merrimac
Amesbury
Salisbury
Windham
Salem
Haverhill
West Newbury
Newburyport
Newbury
Pelham
Methuen
Groveland
Georgetown
Rowley
Ipswich
Dracut
Lawrence
Andover
North Andover
Boxford
Topsfield
Hamilton
Essex
Rockport
Gloucester
Manchester
Wenham
Beverly
Danvers
Peabody
Salem
Lynn
Saugus
Lynnfield
Middleton
Reading
Wilmington
Tewksbury
Lowell
Chelmsford
Westford
Billerica
Carlisle
Bedford
Burlington
Woburn
Wakefield
Melrose
Malden
Medford
Everett
Revere
Winthrop
Atlantic Ocean

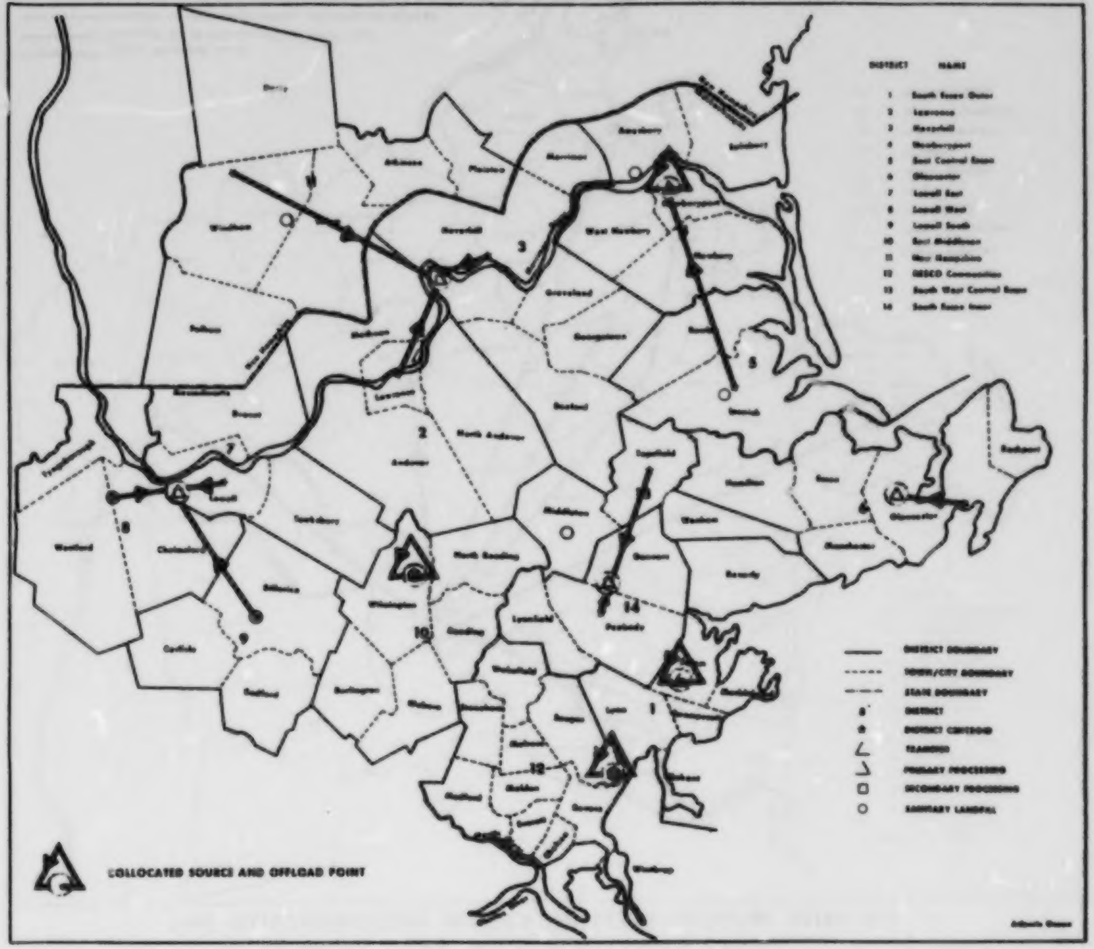
Intercept Parameterization

In this parameterization, all base case processing cost intercepts (not including sanitary landfill and transfer stations) were doubled in run E-1, and halved in Run E-2, to represent the effect of stronger and weaker economies of scale. Both runs were operated through phase 4.

Maps 47 and 48 display the results of run E-1, and maps 49 and 50 display the results of run E-2. It will be noted that both E-1 and E-2 solutions are identicial to the base case.

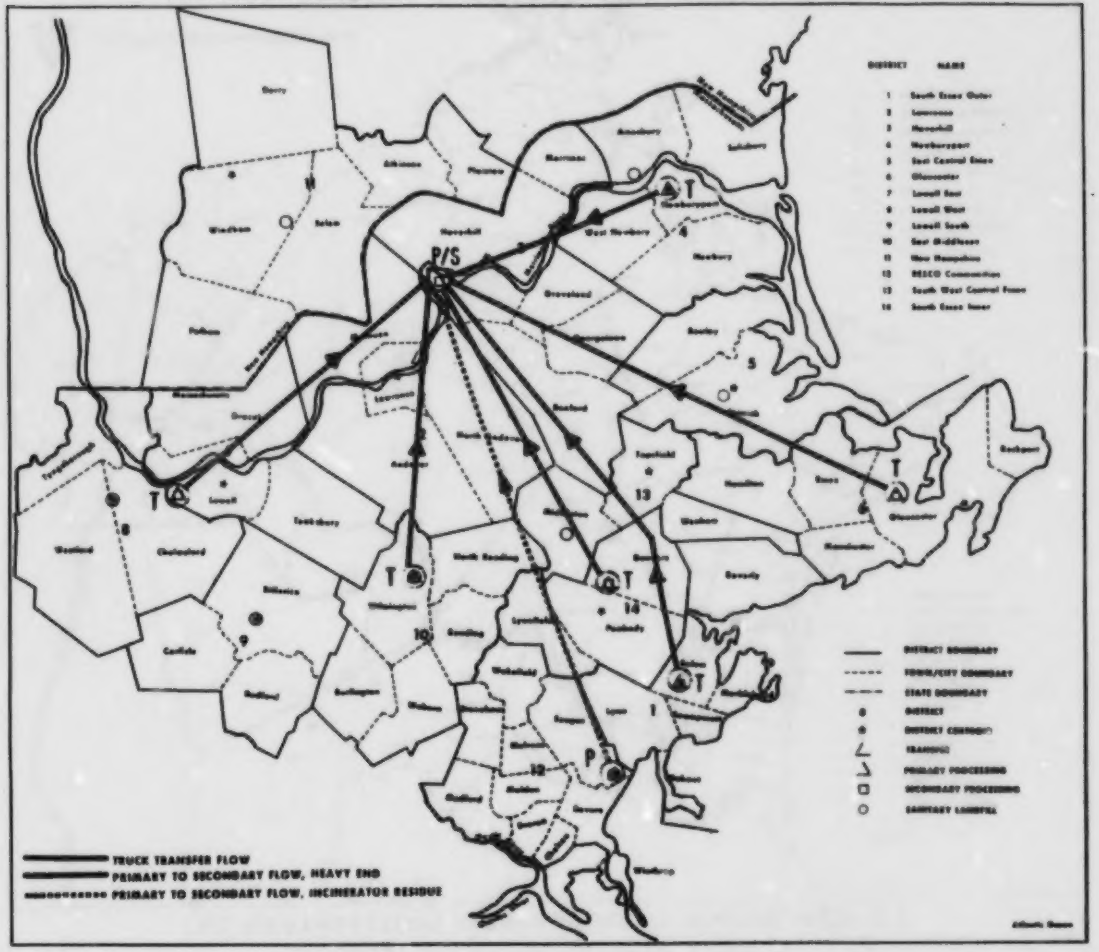
Map 47

FLOWS TO INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN E-1


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
Derry
Haverhill
Groveland
North Andover
Andover
Lowell
Westford
Chelmsford
Billerica
Tewksbury
North Reading
Wilmington
Peabody
Lynn
Gloucester
Ipswich

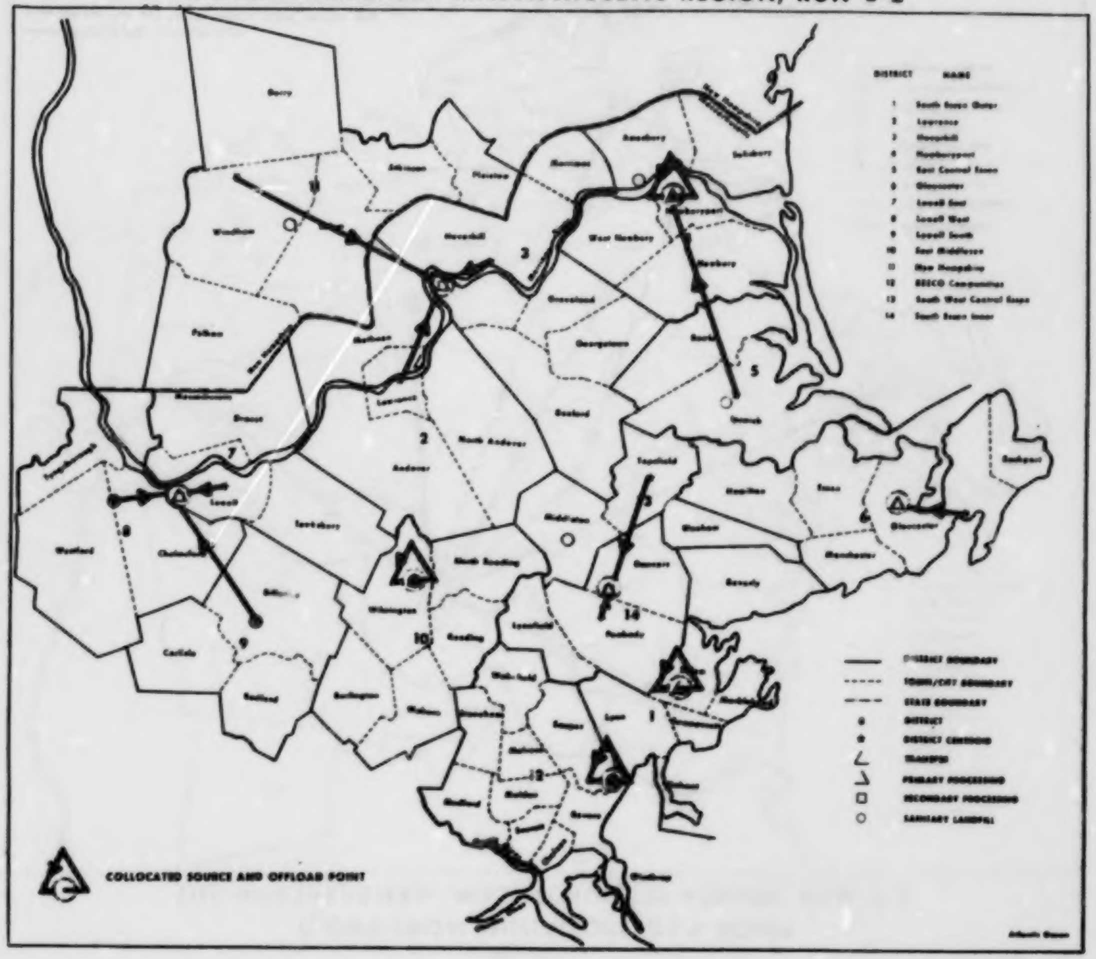
Map 48

FLOWS FROM INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN E-1


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Connection
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE
P/S
T
T
T
T
T
T
P
Haverhill
West Newbury
Newburyport
Newbury
Groveland
Lowell
Gloucester
Tewksbury
Chelmsford
Westford
Billerica
Carlisle
Bedford
Wilmington
North Reading
Peabody
Lynn
Salem
Beverly
Topsfield
Andover
Atkinson
Salem
Windham
Pelham
Derry
Amesbury
Salisbury
Rockport
Woburn
Burlington
Wakefield
Saugus
Reading
Atlantic Ocean

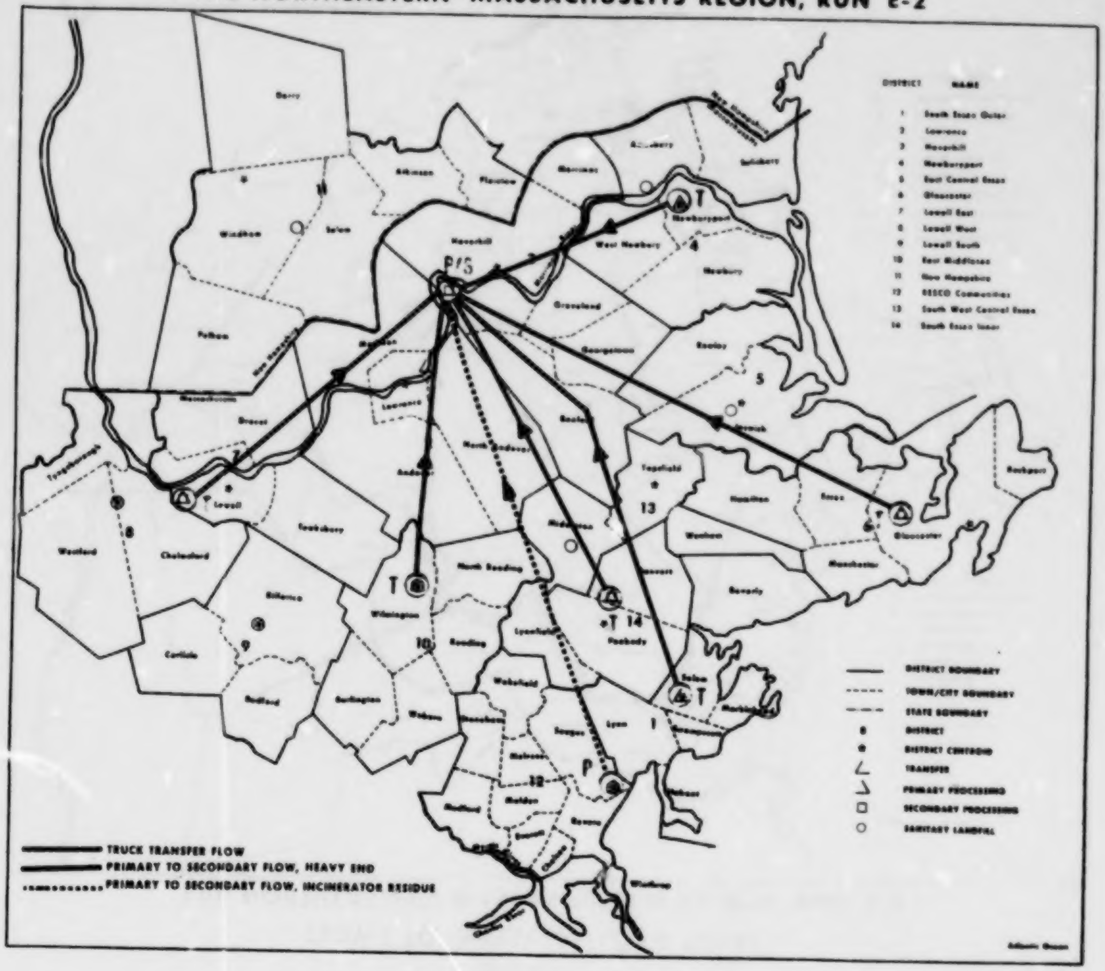
Map 49

FLOWS TO INITIAL OFFLOAD POINT :
THE NORTHEASTERN MASSACHUSETTS REGION, RUN E-2


DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 REECO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
COLLOCATED SOURCE AND OFFLOAD POINT
Derry
Haverhill
Andover
North Andover
Lowell
Atlantic Ocean

Map 50

FLOWS FROM INITIAL OFFLOAD POINT : THE NORTHEASTERN MASSACHUSETTS REGION, RUN E-2


P/S
T
P
DISTRICT NAME
1 South Essex Outer
2 Lawrence
3 Haverhill
4 Newburyport
5 East Central Essex
6 Gloucester
7 Lowell East
8 Lowell West
9 Lowell South
10 East Middlesex
11 New Hampshire
12 RESCO Communities
13 South West Central Essex
14 South Essex Inner
DISTRICT BOUNDARY
TOWN/CITY BOUNDARY
STATE BOUNDARY
DISTRICT
DISTRICT CENTROID
TRANSFER
PRIMARY PROCESSING
SECONDARY PROCESSING
SANITARY LANDFILL
TRUCK TRANSFER FLOW
PRIMARY TO SECONDARY FLOW, HEAVY END
PRIMARY TO SECONDARY FLOW, INCINERATOR RESIDUE
Derry
Windham
Salem
Pelham
Atkinson
Plaistow
Haverhill
Merrimac
Amesbury
Salisbury
Newburyport
West Newbury
Newbury
Groveland
Georgetown
Rowley
Ipswich
Essex
Rockport
Gloucester
Hamilton
Wenham
Manchester
Beverly
Topsfield
Boxford
North Andover
Andover
Lawrence
Methuen
Dracut
Tyngsborough
Lowell
Tewksbury
Chelmsford
Westford
Billerica
Carlisle
Bedford
Burlington
Wilmington
North Reading
Reading
Woburn
Lynnfield
Peabody
Salem
Marblehead
Lynn
Saugus
Wakefield
Malden
Medford
Revere
Winthrop
Atlantic Ocean

CHAPTER 3

INPUTS AND ASSUMPTIONS FOR THE OPERATIONAL TEST AND EXERCISE RUNS

This chapter presents inputs and assumptions for all of the operational test and exercise runs.

Source Data

Source location and tonnage assumptions are presented as follows:

Table I	Static St. Louis Runs
Table II	Dynamic St. Louis Run
Table III	The Massachusetts Exercise Series

(these are Figures 2, 3, & 14).

The source haul cost in all runs for all sources is $.113 per ton-minute, representing a 20 cubic yard packer truck with a 3-man crew, and an average between the cost of private and public ownership. This is a recent MITRE estimate.

Site Data

Site locations and (where applicable) land availability are presented as follows:

Table IV	Static St. Louis Runs
Table V	Dynamic St. Louis Run
Table VI	The Massachusetts Exercise Series

(these are Figures 6, 11, & 15).

All of these sites were not offered in all of the runs. Chapter 4 presents the site-process-linear segments offered and selected for each run.

A site preparation cost of -$196,570 was applied to site 607 in the Massachusetts exercise program runs, representing the annual amortized value of an EPA grant, available only if process 906 (secondary processing -- the Bureau of Mines process) is selected at that site (Lowell, Massachusetts). Process 906 was the only process offered at that site; thus the site preparation cost was a convenient way of applying the grant value to the site-process.

Table I
DISTRICT CENTROID LOCATIONS AND TONNAGE GENERATION ASSUMPTIONS FOR THE STATIC ST. LOUIS RUNS*

SOURCE DISTRICT		CENTROID LOCATION		TONNAGE 000 TONS PER YEAR	
		LONG DEG.|MIN	LAT DEG.|MIN	OTHER RUNS	ST. LOUIS E
101	DISTRICT 1	91 15.80	38 31.80	5.9	5.1
102	DISTRICT 2	90 58.20	38 25.50	32.0	28.9
103	DISTRICT 3	90 43.00	38 18.20	4.5	4.3
104	DISTRICT 4	90 32.50	38 25.90	10.9	10.3
105	DISTRICT 5	90 25.80	38 18.40	53.3	48.5
106	DISTRICT 6	90 20.30	38 08.40	1.1	1.0
107	DISTRICT 7	90 10.80	38 22.10	14.9	14.1
108	DISTRICT 8	90 07.60	38 36.40	218.2	205.0
109	DISTRICT 9	89 59.50	38 33.40	86.9	74.9
110	DISTRICT 10	89 51.10	38 32.30	38.2	23.3
111	DISTRICT 11	89 50.10	38 15.70	13.7	12.9
112	DISTRICT 12	90 04.10	38 27.20	9.9	8.7
113	DISTRICT 13	90 05.90	38 42.50	103.5	92.0
114	DISTRICT 14	90 06.00	38 52.30	148.4	135.3
115	DISTRICT 15	89 56.90	38 55.20	16.8	15.0
116	DISTRICT 16	89 45.20	38 44.60	16.7	14.5
117	DISTRICT 17	90 50.40	38 40.00	2.3	2.1
118	DISTRICT 18	90 42.80	38 48.20	35.8	33.3
119	DISTRICT 19	90 47.90	38 52.00	1.1	1.0
120	DISTRICT 20	90 30.70	38 47.10	44.4	39.8
121	DISTRICT 21	90 20.60	38 53.70	3.7	3.5
122	DISTRICT 22	90 34.30	38 37.20	58.1	46.8
123	DISTRICT 23	90 30.50	38 31.70	46.6	38.4
124	DISTRICT 24	90 24.30	38 43.90	147.0	122.5
125	DISTRICT 25	90 16.80	38 44.70	330.9	282.1
126	DISTRICT 26	90 15.60	38 38.80	514.0	405.5
127	DISTRICT 27	90 27.10	38 37.30	67.0	52.2
128	DISTRICT 28	90 16.40	38 34.90	339.8	282.4
129	DISTRICT 29	90 19.50	38 31.10	128.4	109.2

---

*Source: Sverdrup & Parcel, Op. Cit., Source: p. 201.

Table II

DISTRICTS, CENTROID LOCATIONS AND TONNAGE GENERATION ASSUMPTIONS FOR THE DYNAMIC ST. LOUIS RUNS*

DISTRICT	CENTROID LOCATION				TONNAGE 000 TONS PER YEAR			
	LONG		LAT		PERIOD			
	DEG.	MIN	DEG.	MIN	1	2	3	4
SOURCE 101 FRANKLIN COUNTY	90	58.2	38	25.5	39.1	50.8	75.9	98.80
SOURCE 102 JEFFERSON COUNTY	90	28.1	38	19.3	65.5	90.6	148.5	202.40
SOURCE 103 MADISON COUNTY	90	03.1	38	49.7	280.1	361.7	539.8	702.30
SOURCE 104 MONROE COUNTY	90	09.8	38	21.1	10.2	14.8	25.1	34.80
SOURCE 105 ST. CHARLES COUNTY	90	32.7	38	47.1	79.3	114.6	195.3	271.00
SOURCE 106 ST. CLAIR COUNTY	89	59.5	38	33.4	358.2	449.1	636.1	803.40
SOURCE 107 ST. LOUIS CITY	90	14.6	38	37.2	795.3	895.6	1070.3	1205.40
SOURCE 108 ST. LOUIS COUNTY	90	21.4	38	40.1	838.7	1075.3	1582.2	2042.20

---

*County centroids were taken from the map in Sverdrup & Parcel, Op. Cit., p. 137. Waste tonnages were estimated for the years 1978 (for period 1), 1984 (for period 2), 1993 (for period 3) and 1999 (for period 4) using interpolations of Sverdrup & Parcel projection II (Ibid, p. 53) which assumed a 2% per year growth rate in solid waste generation per capita.

Table III

DISTRICTS, CENTROID LOCATIONS AND TONNAGE GENERATION ASSUMPTIONS FOR THE MASSACHUSETTS EXERCISE PROGRAM

DISTRICT		CENTROID LOCATION LONG DEG. | MIN	CENTROID LOCATION LAT DEG. | MIN	TONNAGE 000 TONS PER YEAR* PERIOD 1
101	SOUTH ESSEX OUTER	70 55.6	42 29.9	189.7
102	LAWRENCE	71 10.0	42 42.1	157.7
103	HAVERHILL	71 04.5	42 46.5	55.7
104	NEWBURYPORT	70 54.9	42 49.2	43.4
105	E CENTRAL ESSEX	70 52.0	42 41.6	12.0
106	GLOUCESTER	70 38.4	42 37.2	45.6
107	LOWELL EAST	71 19.2	42 38.0	129.1
108	LOWELL WEST	71 24.3	42 37.4	38.3
109	LOWELL SOUTH	71 17.0	42 32.5	53.4
110	EAST MIDDLESEX	71 09.3	42 34.6	108.0
111	NEW HAMPSHIRE	71 19.0	42 51.0	115.1
112	RESCO COMMUNITIES	70 58.8	42 26.9	186.0
113	S W CENTRAL ESSEX	70 56.4	42 38.1	11.4
114	SOUTH ESSEX INNER	70 59.0	42 32.9	72.5

---

*Tonnages were doubled for N. E. Massachusetts B-1 and halved for N. E. Massachusetts B-2.

Table IV

SITES AND SITE LOCATIONS FOR THE STATIC ST. LOUIS RUNS

SITE	LOCATION LONG DEG.	LOCATION LONG MIN	LOCATION LAT DEG.	LOCATION LAT MIN	(FOR ULTIMATE SITES ONLY) ACRE-FEET AVAILABLE
501 M1 TRANS	91	01.10	38	26.80	
502 M2 TRANS	90	00.70	38	35.50	
503 M3 TRANS	90	06.90	38	53.60	
504 M4 TRANS	90	33.70	38	08.90	
505 M5 TRANS PROC	90	12.90	38	40.10	
506 M6 T4 TRANS PROC	90	16.70	38	34.90	
507 M7 T5 TRANS PROC	90	08.80	38	37.70	
508 M8 T2 TRANS	90	20.80	38	35.50	
509 M9 C2 TRANS	90	42.20	38	49.70	
510 M10 T6 TRANS PROC	90	30.60	38	30.80	
511 M11 C1 TRANS	90	14.60	38	47.90	
512 T1 TRANS	90	25.20	38	44.70	
513 T3 TRANS	90	11.10	38	42.60	
514 U1 MERAMEC MKT PROC	90	19.40	38	26.00	
515 U2 LABADIE MKT PROC	90	52.00	38	32.40	
605 M5 SECOND PROC	90	12.90	38	40.10	
606 M6 SECOND PROC	90	16.70	38	34.90	
607 M7 SECOND PROC	90	08.80	38	37.70	
610 M10 SECOND PROC	90	30.60	38	30.80	
614 U1 MERAMEC SECOND PROC	90	19.40	38	26.00	
615 U2 LABADIE SECOND PROC	90	52.00	38	32.40	
701 A1 SULLIVAN MUNICIPAL	91	08.00	38	13.50	1000
702 A2 FRANKLIN COUNTY	90	56.10	38	22.00	1000
703 A5 WEST COUNTY	90	31.60	38	31.60	800
704 A6 JEFFERSON COUNTY	90	25.80	38	12.60	400
705 A8 ALTON MUNICIPAL	90	11.30	38	53.60	500
706 A9 MAL	90	10.00	38	44.90	5000
707 A10 MODERN SANITATION	90	01.90	38	30.80	400
708 A14 BROWN MARISSA	89	47.40	38	16.10	400
709 A16 BARTON-ROXANNA	90	00.90	38	50.50	500
710 A18 ANTONIA	90	25.80	38	20.50	250
711 A19 VIGUS QUARRY	90	28.90	38	44.70	3000
712 A21 VALLEY DISPOSAL	90	24.40	38	26.30	400
713 A22 ALTON BRICK	90	24.40	38	40.00	1000

Table V

SITES AND SITE LOCATIONS FOR THE DYNAMIC ST. LOUIS RUN

SITE	LOCATION				(FOR ULTIMATE SITE ONLY)
	LONG		LAT		
	DEG.	MIN	DEG.	MIN	ACRE-FEET AVAILABLE
SITE 501 M1 TRANS	91	01.1	38	26.8	
SITE 506 M6 PROCESSING	90	16.7	38	34.9	
SITE 507 M7 TRANS/PYROLYSIS	90	08.8	38	37.7	
SITE 509 M9 TRANS	90	42.2	38	49.7	
SITE 510 M10 TRANS/PYROLYSIS	90	30.6	38	30.8	
SITE 514 U1 MKT/PROCESSING	90	19.4	38	26.0	
SITE 711 A19 VIGUS QUARRY	90	28.9	38	44.7	20000

Table VI

SITES AND SITE LOCATIONS FOR THE MASSACHUSETTS EXERCISE PROGRAM

SITE		LOCATION LONG DEG.	LOCATION LONG MIN	LOCATION LAT DEG.	LOCATION LAT MIN	(FOR ULTIMATE SITE ONLY) ACRE-FEET AVAILABLE
SITE 501	SALEM INCINERATOR/TR	70	55.6	42	29.9	
SITE 502	LAWRENCE INCIN/TRANS	71	08.3	42	42.8	
SITE 503	HAVERHILL PROCESSING	71	07.3	42	45.7	
SITE 504	NEWBURYPORT TR/PROC	70	54.9	42	49.2	
SITE 506	GLOUCESTER TR/PROC	70	43.3	42	37.1	
SITE 507	LOWELL INCIN/TR/PROC	71	21.4	42	37.7	
SITE 510	EA MIDDLESEX TRANS	71	09.3	42	34.6	
SITE 512	RESCO PROCESSING	70	58.8	42	26.9	
SITE 514	SO ESSEX INNER TR/PR	70	58.7	42	33.6	
SITE 603	HAVERHILL SCDY RECOV	71	07.3	42	45.7	
SITE 607	LOWELL EA SCDY RECOV	71	21.4	42	37.7	
SITE 614	SO ESX INR SCDY RECOV	70	58.7	42	33.6	
SITE 633	HAV DUMMY INCIN RES	71	07.3	42	45.7	
SITE 634	SO ESX DUMMY INCIN RES	70	58.7	42	33.6	
SITE 637	LWL DUMMY INCIN RES	71	21.4	42	37.7	
SITE 643	HAV DUMMY HEAVY END	71	07.3	42	45.7	
SITE 644	SO ESX DUM HEAVY END	70	58.7	42	33.6	
SITE 647	LWL DUMMY HEAVY END	71	21.4	42	37.7	
SITE 704	AMESBURY LANDFILL	70	56.9	42	49.9	5000
SITE 705	IPSWICH LANDFILL	70	52.9	42	41.0	1000
SITE 706	GLOUCESTER LANDFILL	70	43.3	42	37.1	1000
SITE 708	LOWELL WEST LANDFILL	71	24.3	42	37.4	1000
SITE 709	LOWELL SOUTH LANDFILL	71	17.0	42	32.5	1000
SITE 710	EA MIDDLESEX LANDFILL	71	09.3	42	34.6	1000
SITE 711	NEW HAMPSHIRE LANDFILL	71	16.0	42	48.0	1000
SITE 712	RESCO LANDFILL	70	58.8	42	26.9	1000
SITE 713	SO CTRL ESX LANDFILL	71	00.0	42	36.2	1000

Process Data

Table VII provides a summary of general information on the processes used in the operational and exercise runs. The haul cost of $0.26 per ton minute is a recent MITRE cost estimate representing a 65 cubic yard truck, one man crew, private ownership, carrying a 17-ton average load.

Table VIII presents the process costs used in the operational test and exercise programs.

Process Cost Notes

Process 901, Transfer, Packer to Van

These costs represent a recent (February, 1975) MITRE estimate based on a critical comparison and cross evaluation of estimates available in the literature.

Total costs and capital costs were estimated, and operating costs treated as residual.

Process 902, Transfer, Packer to Container

This process covers packing waste into a container, which is then trucked to a rail head by flat-bed truck, and transported by rail to either of the utility sites.

Costs were obtained from Sverdrup and Parcel[10] at scales of 300 and 1000 TPD, assuming public ownership and an average speed of 35 MPH.

All costs except a cost per one-way truck mile of $.03215 were included in the process cost for process 902. The per truck mile cost was solved for the numbers of minutes which would generate the correct cost, and that number of minutes entered at a standard cost per ton-minute of $.026. Thus, for site 509, a distance of 16 miles to T1 (site 512) was translated into a cost of $1.0288, which would be generated by a time of 9.8 minutes. The 9.8 minutes was then used with a category 5 transportation activity to each of 514 (Meramec) and 515 (Labadie). Similarly, a distance of 14 miles between site 511 and T1 was translated into 7.0 minutes, which was entered into a separate category 5 transportation activity to each of sites 514 and 515.

The total costs were assumed to be 70% operating cost and 30% capital cost.

---

[10] Op. Cit., p. 208.

Table VII

GENERAL PROCESS INFORMATION

Process No.	Process Name	New or Existing	Level	% Output by weight	Output Haul Cost $/ton-minute	Density in Landfill[1] lbs/ft^3	Appli-cation[2]	Input Links[2]	Output Links[2]
901	Transfer, Packer to Van	N	A	100	.026	750	S,D,M	Source	903, 905, 907, 915, 925, 935, 955
902	Transfer, Packer to Container	N	A	100	.026	750	S	Source	905
903	Transfer, Packer or Van to Rail	N	A	100	NA	750	S	Source, 901	905
905	Shredded Fuel	N	B	13	.026	1000	S,M	Source 901, 902, 903	906(S); 907; 946(M)
906	Secondary Processing	N	C	0	-	-	S,M	905(S); 936(M); 946(M)	-
907	Sanitary Landfill	N	D	0	-	-	S,D,M	Source 901, 905 925	-
915	RESCO (Steam Recov. Incin.)	E	B	25	.026	1200	M	Source, 901	917,936
917	RESCO Landfill	E	D	0	-	-	M	915	-
925	Dried Shredded Fuel	N	B	13	.026	1000	M	Source, 901	907, 946
935	Gas Pyrolysis	N	B	0	-	-	D,M	Source, 901	-
936	Dummy Incinerator Residue	N	C	100	.026	1200	M	915	906
946	Dummy Heavy End	N	C	100	.026	1000	M	905, 925	906
955	Composite: Shredded Fuel/Sec. Rec.	N	B	0	-	-	D	Source, 901	-

[1] Effective density: weight of residue in pounds divided by volume of residue plus cover in cubic feet.
[2] S = St. Louis Static; D = St. Louis Dynamic; M = Massachusetts Exercise Program

Table VIII

PROCESS COSTS FOR THE OPERATIONAL TEST AND EXERCISE PROGRAMS

Slopes are in dollars per ton; Intercepts are in thousands of dollars per year

Process No.	Process Name	Segment	Capital Slope	Capital Intercept	Operating Slope	Operating Intercept
901	Transfer, Packer to Van	1	.77885	14.0	.66346	22.0
		2	.35962	27.5	.3423	50.5
		3	.12115	54.2	.2875	66.8
902	Transfer, Packer to Container	1	1.674	8.1	3.906	18.9
		2	1.518	24.9	3.542	58.1
		3	1.44	60.0	3.36	140.0
903	Transfer, Packer or Van to Rail	1	2.789942	50.15	4.6766	78.807
		2	1.288205	98.509	3.526163	180.898
		3	.433975	194.151	3.329862	239.286
905	Shredded Fuel Process	1	2.980649	317.0 [1]	3.070175	70.0 [1]
		2	.908084	668.0	1.874698	320.0
		3	.441506	1098.0	1.50641	710.0
906	Secondary Recovery	1	1.26	176.7 [1]	3.1	155.0 [1]
		2	.75	201.5	1.4	372.0
		3	.12	444.85	1.08	472.75
907	Sanitary Landfill	1	.546875	8.525	1.640625	76.725
		2	.36	13.95	1.08	125.550
		3	.2115	25.575	.6345	230.175
915	RESCO Process	1	0	0	5.271	265.0 [1]
		2			2.76	950.0
917	RESCO Landfill	1	0	0	.46	0
925	Dried Shredded Fuel	1	4.5	234.0 [1]	9.35	386.0 [1]
		2	2.2	581.25	4.46667	1247.75
		3	1.15	1026.1	2.85	2197.9
935	Gas Pyrolysis	A	2.21333	249.6 [1]	5.33967	374.4 [1]
		B[2]	0	386.83	0	705.46
936	Dummy INCIN Residue	1	0	0	0	0
946	Dummy Heavy End	1	0	0	0	0
955	Shredded Fuel/Secondary Recovery (Composite)	1	3.145	493.7	3.473	225.0
		2	1.072	844.7	2.278	475.0
		3	.54	1299.5	1.688	1082.0

[1] The indicated process intercepts were doubled in Massachusetts exercise run E-1, and halved in Massachusetts exercise run E-2; in process 935, segment B, the true intercepts (equal to the intercepts in segment A of the process) were doubled for run E-1 and halved for run E-2.

[2] The A segment is the standard segment, entering as segment 1 in St. Louis Dynamic and as segment 2 in the Massachusetts exercise program. Segment B is valid only up to 200 tons. It charges the full cost of a 200 TPD operation as intercept.

Process 903, Transfer, Packer or Van to Rail

This process includes the repacking of waste into a container at a rail head, and the shipment of the container to either of the utility sites. The costs were obtained from Sverdrup and Parcel,[11] representing a scale of 9000 tons per week. The costs include $2.30 per ton for rail haul, independent of distance.

The costs were parameterized for scale, and allocated to capital and operating cost categories, using the process 901 costs as factors.

Process 905, Shredded Fuel Process

This is the Union Electric process, and includes shredding, air classification at 80% light/20% heavy, and magnetic separation of ferrous metals.

Cost estimates were obtained from Union Electric project staff at scales of 2,000 and 6,000 tons per day.

Because of sharply differing log linear slopes, the capital and operating costs were estimated independently.

Process 906, Secondary Recovery

This is the Bureau of Mines incinerator residue process which was, at the time of the runs, to be demonstrated in Lowell, Massachusetts. Based on conversations with Raytheon staff, it has been assumed incinerator residue and air classification heavy end are interchangeable as inputs into this process.[12]

The costs for this process were taken from the earlier Massachusetts Application.[13] The operating and total costs were estimated, and the capital costs taken as a residual.

Process 907, Sanitary Landfill

The costs for this process were taken from the earlier Massachusetts application. Capital costs were assumed to be 10% of the intercept and 25% of the slope.

---

[11] Op. Cit., p. 207.

[12] We were informed that this was the case as long as the heavy end did not exceed 10% organic matter.

[13] See E. B. Berman and H. J. Yaffe, Op. Cit., p. 29.

Process 915, RESCO Process

This process represents a plant now under construction in Saugus, Mass., for the recovery of steam in a water-wall incinerator. The costs were estimated by MITRE. Because the process has been coded existing, only the operating costs have been included.

In this one case, the revenue has been subtracted from the operating cost slope.

Process 917, RESCO Landfill

This is a special process for the deposit of RESCO residue on a co-located landfill. The cost of 46¢ per residue ton includes haul.

Process 925, Dried Shredded Fuel

This is basically the ECOFUEL process, in which both the heavy end and the light end are dried. Like process 905, ferrous metal is generated from the primary process.

Costs have been drawn from the earlier Massachusetts application.[14] Total cost and capital cost estimates were made, and the operating costs were treated as a residual.

Process 935, Gas Pyrolysis

Segment A in Table VIII is the basic process cost, identified as segment 1 in St. Louis G and segment 2 in the Massachusetts Exercise program.

Segment B is a special treatment of the process for low tonnage applications. Where the tonnage cannot exceed 200 tons per day, which is a proper minimum tonnage for the process, segment B is assigned. In this segment, the full cost of operation at 200 tons per day is charged as intercept cost. At operation below that level, revenue is lost, but the costs are not reduced. The segment requires constraint to a 200 ton per day maximum, since tonnages beyond that have no meaning (they would generate no processing costs). This segment is used in the Massachusetts exercise program at Newburyport (site 504) and Gloucester (site 506).

Costs were drawn from the earlier Massachusetts application.[15] The costs were allocated 60% to operating cost and 40% to capital cost.

Process 936, Dummy Incinerator Residue

This is a dummy process with zero processing cost. The process exists to generate a proper revenue (differentiated from heavy end revenue). This process drives process 906, secondary recovery, always at the same site, for process costs.

---

[14] Ibid, p. 28.

[15] Ibid, p. 28-29.

Table IX

RECOVERED MATERIALS, COMPOSITIONS AND VALUES

Material	Unit	Composition, Units Per Input Ton		Market Location (St. Louis)	Market Value in Dollars Per Unit		Source Process
		St. Louis	Mass.		St. Louis (delivered)	Mass. (cost of haul included)	
Shredded Fuel	MBTU	7 MBTU/ton (.8 tons/ton)	7 MBTU	Meramec/Labadie	.30	.30	905
Ferrous (No. 2 bundle)	Ton	.065	.065	Granite City	57.00	57.00	905/925
Glass	Ton	.1177	.1769	Alton	40.00	20.00	906/946
Aluminum	Ton	.02308	.0346	Belleville	300.00	300.00	906/946
Other Non-ferrous	Ton	.0145	.02308	St. Louis	700.00	700.00	906/946
Fill	Ton	.5023	-	St. Louis	2.15	0 (given away)	906/946
Steam	NA	NA	[A revenue has been incorporated into the process cost]				915
Shredded Fuel	MBTU	NA	7	NA	NA	.60	925
Gas	MBTU	7.44	7.44	at site	2.00	1.00	935
Frit	Ton	.22	.22	at site	3.00	3.00	935
Ferrous (No. 2 bundle)	Ton	NA	NA	NA	NA	57.00	936
Glass	Ton	NA	.092	NA	NA	20.00	936
Aluminum	Ton	NA	.0180	NA	NA	300.00	936
Other Non-ferrous	Ton	NA	.0120	NA	NA	700.00	936
Fill	Ton	NA	-	NA	NA	0 (given away)	936

Sources: Massachusetts Composition, Ibid., pp. 28-29, except ferrous was raised to .065. St. Louis Composition: Estimates were received from East-West Gateway Coordinating Council. These appeared high, so that the lesser of that and the Massachusetts composition was taken in each case, and, except for fuel and ferrous, reduced a further third to allow for loss in air classification. Market values for Massachusetts were MITRE estimates, and for St. Louis were East-West Gateway Coordinating Council estimates. Union Electric project staff have suggested that the above aluminum composition and glass market value are excessive for St. Louis.

Table X

HAUL ASSUMPTIONS FOR RECOVERED MATERIALS IN ST. LOUIS RUNS

Table of One-Way Minutes for Truck-Haul

Processing Site / Market	(Glass) Alton	(Aluminum) Belleville	(Ferrous) Granite City	(Other Non-Ferrous and Fill) St. Louis	Runs A, B, and G		Not Used
					(Fuel) Meramec	(Fuel) Labadie	(Fuel) Baldwin
505/605	12.0	16.0	40.0	0	39.0	67.8	NA
506/606	54.7	28.0	24.0	0	34.2	60.0	NA
507/607	39.3	2.8	20.5	12.0	47.9	69.0	NA
510/610	75.2	30.8	60.0	40.0	36.0	40.0	63.0
514/614	41.0	36.0	28.0	34.0	0	NA	NA
515/615	174.0	144.0	168.0	132.0	NA	0	NA

The cost of truck haul per ton is \$.052 per one-way minute plus \$.52 for turn-around time.

Truck haul of fuel to the nearest utility (always Meramec) was used in runs A, B, and G.

Rail haul of fuel at a flat cost of \$3.00 per ton (regardless of destination) was used in runs A-1, B-1, C, and E.

Haul of fuel was irrelevant in runs F and F-1.

Table XI

REVENUE ASSUMPTIONS FOR OPERATIONAL TEST AND EXERCISE RUNS
All Revenues in Dollars Per Ton of Process Input

	Process / Site	505 605	506 606	507 607	510 610	514 614	515 615	All Mass.
Runs A, B, &G	905 Shredded Fuel Truck Haul	3.598	3.852	3.293	3.654	5.677	5.203	5.810
Runs A-1, B-1, C & E	905 Shredded Fuel Rail Haul	3.236	3.291	3.302	3.168			
	906 Secondary Recovery	22.426	22.150	21.952	20.947	21.311	(fill excluded) 20.363	NA
	915 RESCO Process	NA	NA	NA	NA	NA	NA	[incorporated into process cost]
	925 Dried Shredded Fuel	NA	NA	NA	NA	NA	NA	7.910
	935 Gas Pyrolysis	NA	15.540	15.540	15.540	15.540	NA	8.100
	936 Dummy Incinerator Residue	NA	NA	NA	NA	NA	NA	19.345
	946 Dummy Heavy End	NA	NA	NA	NA	NA	NA	30.077
	955 Shredded Fuel/Secondary Recovery Composite (905 revenue plus 13% of 906 revenue for site)	NA	6.732	NA	NA	8.447	NA	NA

Process 946, Dummy Heavy End

This is a dummy process with zero processing cost. The process exists to generate a proper revenue (differentiated from incinerator residue revenue). This process drives process 906, secondery recovery, always at the some site, for process costs.

Process 955, Shredded Fuel/Secondary Recovery Composite

This is a composite representing process 905 plus 13% of process 906 at the same site. The segments have been formed as follows:

> Each segment of 955 uses the slopes and intercepts of the corresponding segment of process 905, and adds to them from process 906:
>
> 955, 1st segment: 1st segment intercepts plus 13% of 1st segment slopes
>
> 955, 2nd segment: 1st segment intercepts plus 13% of 1st segment slopes
>
> 955, 3rd segment: 2nd segment intercepts plus 13% of 2nd segment slopes.

Revenues

Table IX presents assumptions on composition (units output per ton input), market location (for St. Louis), and market value. No market locations were identified for the Massachusetts runs.

Table X presents haul assumptions for recovered materials in the St. Louis runs. There is no counterpart for the Massachusetts runs.

Table XI presents the final revenues entered into the models.

Constraints

Land-availability constraints have been included under site data. This subsection describes tonnage and truck constraints.

St. Louis A, B, and B-1

Truck constraints of 150,000 per year were applied at sites:

505/605
506/606
507/607
510/610
and 515/615.

A truck constraint of 56,000 per year was applied at sites 514/614.

St. Louis A-1, C, and E

Truck constraints of 150,000 per year were applied at sites 505/605 and 506/606.

St. Louis F

There were no truck constraints. A tonnage constraint of 624,000 per year was applied at site 514 (Meramec).

St. Louis F-1

Truck constraints of 150,000 per year were applied at sites 505/605 and 506/606. A tonnage constraint of 1,267,000 per year was applied at site 514 (Meramec).

St. Louis G

No truck or tonnage constraints.

N.E. Massachusetts

Tonnage constraints for all runs were as follows:

Site 504, Newburyport

Process 935, Gas Pyrolysis, 62,000 tons per year*
Other processes 1,240,000 tons per year

Site 506, Gloucester

Process 935, Gas Pyrolysis, 62,000 tons per year*
Other processes 1,240,000 tons per year

Site 512, RESCO

Process 915, RESCO Process, 465,000 tons per year.

Truck constraints for all runs except D-1 and D-2 were applied at 390,000 per year at site:

503/633/643 (Haverhill)

507/637/647 (Lowell)

514/634/644 (Danvers).

For the same sites, truck constraints of 105,000 per year were applied in run D-1, and truck constraints of 40,000 per year were applied in run D-2.

---

*See the discussion of this process under Process data.

Transportation Data

The transportation files for all of the operational test and exercise program runs are shown as follows:

Table XII	St. Louis A
Table XIII	St. Louis A-1 and E
Table XIV	St. Louis B and B-1
Table XV	St. Louis C
Table XVI	St. Louis F
Table XVII	St. Louis F-1
Table XVIII	St. Louis G
Table XIX	N. E. Massachusetts A
Table XX	all other N. E. Massachusetts runs.

The East-West Gateway Coordinating Council provided all of the one-way time estimates for the St. Louis runs, and corresponding estimates were prepared by MITRE for the Massachusetts runs.

An input error crept into the model input, and unfortunately, since it involved an underestimate of time, the error affected the solution. The error affects all St. Louis runs except F-1 and G. The error has been corrected by hand calculation in all of the affected runs. Section 5 presents all solution costs and activity levels before and after the correction (referred to as the District 118 mod.).

The input error affected the transportation files, and is corrected in the following tables.

The two erroneous transportation entries are:

Code	Origin	Origin Process	Destination	Entered Minutes	Correct Minutes
2	118	118	508	0.1	57.0
2	118	118	509	14.0	4.0

Miscellaneous Assumptions

For all static runs, a 20 year planning period was assumed; for St. Louis G, there were four periods of 3, 10, 7, and 5 years for 25 years in total. The standard turnaround time (charged for all haul in which the origin is a site, and included in the haul cost for recovered materials) was 20 minutes in all runs.

Table XII

Page 1 of 3

TRANSPORTATION FILE, ST. LOUIS A

CODE	ORIG		DEST	MIN
	SI	PROC		
2	101	101	501	30.4
2	101	101	510	127.4
2	101	101	515	84.9
2	102	102	501	5.2
2	102	102	510	44.5
2	102	102	515	24.0
2	103	103	501	95.0
2	103	103	504	32.0
2	103	103	510	97.6
2	103	103	514	60.0
2	103	103	515	53.2
2	104	104	509	34.5
2	104	104	510	12.3
2	104	104	514	60.8
2	105	105	504	34.0
2	105	105	505	6.1
2	105	105	508	74.5
2	105	105	510	44.0
2	105	105	514	16.0
2	106	106	504	36.0
2	106	106	506	45.5
2	106	106	508	47.8
2	106	106	510	60.0
2	106	106	514	49.6
2	107	107	507	26.0
2	107	107	514	32.0
2	108	108	506	12.0
2	108	108	507	4.0
2	108	108	513	19.0
2	109	109	502	2.2
2	109	109	506	40.0
2	109	109	507	30.0
2	109	109	513	32.0
2	110	110	502	16.7
2	110	110	506	40.5
2	110	110	507	15.3
2	110	110	513	35.0
2	111	111	502	64.0
2	111	111	506	124.0
2	111	111	507	60.0
2	112	112	502	43.0
2	112	112	506	24.3
2	112	112	507	30.0
2	112	112	514	32.0
2	113	113	502	54.0
2	113	113	505	14.0
2	113	113	506	25.0
2	113	113	507	17.1
2	113	113	513	8.0
2	114	114	503	0.1
2	114	114	511	23.7
2	114	114	513	27.2
2	115	115	503	17.6
2	115	115	511	46.0
2	115	115	513	100.1
2	116	116	502	44.0
2	116	116	507	39.3
2	116	116	513	48.0
2	117	117	509	40.0
2	117	117	510	68.0
2	117	117	512	57.6
2	117	117	515	60.0
2	118	118	508	0.1 [1]
2	118	118	509	14.0 [2]
2	118	118	510	52.0
2	118	118	512	34.4
2	118	118	515	52.8
2	119	119	509	9.5
2	119	119	510	24.8
2	119	119	512	44.5
2	119	119	515	36.0
2	120	120	508	42.5
2	120	120	509	14.0
2	120	120	510	37.2
2	120	120	512	11.2
2	120	120	515	76.9
2	121	121	505	56.0
2	121	121	509	39.3
2	121	121	511	30.9
2	121	121	512	34.0
2	122	122	506	52.8
2	122	122	508	29.8
2	122	122	510	18.8
2	122	122	512	38.4
2	122	122	515	32.5
2	123	123	506	23.7
2	123	123	508	19.2
2	123	123	510	1.8
2	123	123	512	25.7
2	123	123	514	57.4

1.) District 118 mod; changed to 57.0 min.
2.) District 118 mod; changed to 4.0 min.

Reproduced from best available copy.

Table XII

Page 2 of 3

CODE	ORIG		DEST	MIN
	SI	PROC		
2	123	123	515	30.3
2	124	124	505	15.2
2	124	124	506	50.8
2	124	124	508	33.4
2	124	124	510	31.4
2	124	124	511	15.0
2	124	124	512	0.1
2	125	125	505	8.9
2	125	125	506	33.6
2	125	125	508	36.0
2	125	125	511	11.7
2	125	125	512	20.0
2	126	126	505	11.0
2	126	126	506	14.4
2	126	126	508	10.9
2	126	126	514	32.9
2	127	127	505	25.5
2	127	127	506	28.4
2	127	127	508	18.2
2	127	127	510	15.9
2	127	127	512	10.7
2	128	128	505	7.2
2	128	128	506	0.1
2	128	128	508	20.0
2	128	128	514	33.1
2	129	129	506	6.7
2	129	129	508	4.0
2	129	129	510	15.9
2	129	129	514	19.2
3	501	901	510	69.0
3	501	901	515	21.6
3	502	901	505	25.5
3	502	901	506	27.0
3	502	901	507	10.4
3	502	901	514	58.1
3	503	901	505	29.9
3	503	901	507	40.0
3	503	901	513	36.0
3	503	901	514	89.0
3	504	901	506	67.3
3	504	901	510	67.3
3	504	901	514	45.2
3	505	901	506	13.3
3	505	901	510	31.9
3	505	901	514	39.0
3	505	905	606	13.3
3	505	905	610	31.9
3	505	905	614	39.0
3	506	901	505	13.3
3	506	901	510	32.0
3	506	901	514	34.2
3	506	905	605	13.3
3	506	905	610	32.0
3	506	905	614	34.2
3	507	901	505	10.3
3	507	901	506	20.0
3	507	901	510	36.0
3	507	901	514	47.1
3	507	905	605	10.3
3	507	905	606	20.0
3	507	905	610	36.0
3	507	905	614	47.9
3	508	901	505	13.6
3	508	901	506	19.2
3	508	901	510	19.6
3	508	901	514	31.5
3	509	901	505	43.5
3	509	901	506	60.0
3	509	901	508	48.0
3	509	901	510	52.2
3	509	901	512	26.0
3	509	901	515	72.0
3	510	901	505	31.9
3	510	901	506	32.0
3	510	901	514	36.0
3	510	905	605	31.9
3	510	905	606	32.0
3	510	905	614	36.0
3	511	901	505	38.2
3	511	901	506	37.4
3	511	901	510	67.3
3	511	901	512	21.0
3	511	901	514	54.3
3	514	905	606	34.2
3	514	905	610	36.0
3	515	905	610	43.0
4	505	905	703	31.9
4	505	905	706	13.2
4	506	905	703	32.0
4	506	905	706	34.2

Table XII

Page 3 of 3

CODE	ORIG		DEST	MIN
	SI	PROC		
4	507	905	706	30.0
4	510	905	703	0.1
4	514	905	703	36.0
4	515	905	703	40.0
5	501	903	514	-0.1
5	501	903	515	-0.1
5	503	903	514	-0.1
5	503	903	515	-0.1
5	504	903	514	-0.1
5	504	903	515	-0.1
5	505	903	514	-0.1
5	505	903	515	-0.1
5	505	905	605	-0.1
5	506	903	514	-0.1
5	506	903	515	-0.1
5	506	905	606	-0.1
5	507	903	514	-0.1
5	507	903	515	-0.1
5	507	905	607	-0.1
5	508	903	514	-0.1
5	508	903	515	-0.1
5	509	902	514	9.8
5	509	902	515	9.8
5	510	903	514	-0.1
5	510	903	515	-0.1
5	510	905	610	-0.1
5	511	902	514	7.3
5	511	902	515	7.3
5	512	903	514	-0.1
5	512	903	515	-0.1
5	513	903	514	-0.1
5	513	903	515	-0.1
5	514	905	614	-0.1
5	515	905	615	-0.1

Page 1 of 2

Table XIII

TRANSPORTATION FILE, ST. LOUIS A-1 AND E

CODE	ORIG		DEST	MIN
	SI	PROC		
2	101	101	501	30.4
2	101	101	510	127.4
2	102	102	501	5.2
2	102	102	510	44.5
2	103	103	501	96.0
2	103	103	504	32.0
2	103	103	510	97.6
2	104	104	508	36.8
2	104	104	510	12.8
2	105	105	504	34.0
2	105	105	506	6.1
2	105	105	508	74.5
2	105	105	510	44.0
2	106	106	504	36.0
2	106	106	506	46.5
2	106	106	508	47.8
2	106	106	510	60.0
2	107	107	507	26.0
2	108	108	506	12.0
2	108	108	507	4.0
2	109	109	502	2.2
2	109	109	506	40.0
2	109	109	507	30.0
2	110	110	502	16.7
2	110	110	506	40.5
2	110	110	507	15.3
2	111	111	502	64.0
2	111	111	506	124.0
2	111	111	507	60.0
2	112	112	502	48.0
2	112	112	506	24.3
2	112	112	507	30.0
2	113	113	502	64.0
2	113	113	505	14.0
2	113	113	506	25.0
2	113	113	507	17.1
2	114	114	503	0.1
2	114	114	511	23.7
2	115	115	503	17.6
2	115	115	511	46.0
2	116	116	502	44.0
2	116	116	507	39.3
2	117	117	509	40.0
2	117	117	510	66.0
2	118	118	508	0.1[1]
2	118	118	509	14.0[2]
2	118	118	510	52.0
2	119	119	509	9.5
2	119	119	510	24.8
2	120	120	508	42.8
2	120	120	509	14.0
2	120	120	510	37.2
2	121	121	505	56.0
2	121	121	509	38.2
2	121	121	511	30.9
2	122	122	506	52.8
2	122	122	508	28.8
2	122	122	510	18.8
2	123	123	506	23.7
2	123	123	508	19.2
2	123	123	510	1.8
2	124	124	505	15.2
2	124	124	506	50.8
2	124	124	508	38.4
2	124	124	510	31.4
2	124	124	511	15.0
2	125	125	505	8.8
2	125	125	506	33.6
2	125	125	508	36.0
2	125	125	511	11.7
2	126	126	505	11.0
2	126	126	506	14.4
2	126	126	508	10.9
2	127	127	505	25.5
2	127	127	506	28.4
2	127	127	508	18.2
2	127	127	510	15.9
2	128	128	505	7.2
2	128	128	506	0.1
2	128	128	508	20.0
2	129	129	506	6.7
2	129	129	508	4.0
2	129	129	510	15.9
3	501	901	510	60.0
3	502	901	505	25.5
3	502	901	506	27.0
3	502	901	507	10.8
3	503	901	505	29.8
3	503	901	507	40.0
3	504	901	506	67.8

1.) District 118 mod; changed to 57.0 min.
2.) District 118 mod; changed to 4.0 min.

Page 2 of 2

Table XIII

CODE	ORIG		DEST	MIN
	SI	PROC		
3	504	901	510	67.8
3	505	901	506	13.3
3	505	901	510	31.9
3	505	905	606	13.3
3	505	905	610	31.9
3	506	901	505	13.3
3	506	901	510	32.0
3	506	905	605	13.3
3	506	905	610	32.0
3	507	901	505	10.3
3	507	901	506	20.0
3	507	901	510	36.0
3	507	905	605	10.3
3	507	905	606	20.0
3	507	905	610	36.0
3	508	901	505	15.6
3	508	901	506	19.2
3	508	901	510	15.6
3	509	901	505	43.5
3	509	901	506	60.0
3	509	901	508	48.0
3	509	901	510	52.2
3	510	901	505	31.9
3	510	901	506	32.0
3	510	905	605	31.9
3	510	905	606	32.0
3	511	901	505	38.2
3	511	901	506	37.6
3	511	901	510	63.3
5	505	905	605	-0.1
5	506	905	606	-0.1
5	507	905	607	-0.1
5	510	905	610	-0.1

Page 1 of 5

Table XIV

TRANSPORTATION FILE, ST. LOUIS B AND B-1

CODE	ORIG		DEST	MIN	CODE	ORIG		DEST	MIN	CODE	ORIG		DEST	MIN
	SI	PROC				SI	PROC				SI	PROC		
1	101	101	701	69.5	1	111	111	707	83.7	1	120	120	711	10.3
1	101	101	702	72.0	1	111	111	708	3.2	1	120	120	713	22.5
1	102	102	701	32.4	1	112	112	706	81.0	1	121	121	703	47.6
1	102	102	702	12.0	1	112	112	707	8.8	1	121	121	705	28.4
1	103	103	701	52.4	1	112	112	708	14.0	1	121	121	706	44.0
1	103	103	702	36.0	1	113	113	706	9.3	1	121	121	711	30.0
1	103	103	704	56.0	1	113	113	707	33.0	1	121	121	713	49.0
1	103	103	710	44.0	1	113	113	709	13.8	1	122	122	702	98.0
1	103	103	712	53.6	1	114	114	705	8.0	1	122	122	703	12.0
1	104	104	703	16.0	1	114	114	706	13.3	1	122	122	711	25.4
1	104	104	710	43.2	1	114	114	709	19.0	1	122	122	713	16.3
1	104	104	712	20.0	1	115	115	705	25.0	1	123	123	702	39.9
1	105	105	704	8.8	1	115	115	706	42.0	1	123	123	703	0.1
1	105	105	710	2.4	1	115	115	709	15.0	1	123	123	711	26.6
1	105	105	712	17.6	1	116	116	706	42.1	1	123	123	712	18.8
1	106	106	704	15.0	1	116	116	707	28.9	1	123	123	713	19.9
1	106	106	710	26.6	1	116	116	709	26.2	1	124	124	703	29.3
1	106	106	712	31.9	1	117	117	702	91.9	1	124	124	705	39.0
1	107	107	707	29.8	1	117	117	703	54.0	1	124	124	706	21.0
1	107	107	709	62.0	1	117	117	711	56.0	1	124	124	711	8.0
1	107	107	710	30.5	1	117	117	713	62.0	1	124	124	713	8.6
1	107	107	712	22.6	1	118	118	702	131.2	1	125	125	705	28.0
1	108	108	706	28.0	1	118	118	703	53.3	1	125	125	706	12.9
1	108	108	707	22.0	1	118	118	711	26.2	1	125	125	711	26.4
1	109	109	706	4.5	1	118	118	713	35.0	1	125	125	713	0.1
1	109	109	707	8.8	1	119	119	702	103.0	1	126	126	703	27.4
1	110	110	706	63.0	1	119	119	703	68.0	1	126	126	706	20.0
1	110	110	707	19.2	1	119	119	711	47.3	1	126	126	713	15.2
1	110	110	708	56.4	1	119	119	713	41.5	1	127	127	703	14.6
1	110	110	709	70.4	1	120	120	703	38.6	1	127	127	711	12.9

Table XIV

CODE	ORIG		DEST	MIN
	SI	PROC		
1	127	127	712	21.3
1	127	127	713	19.2
1	128	128	703	70.1
1	128	128	706	36.0
1	128	128	711	42.7
1	128	128	712	29.5
1	128	128	713	6.0
1	129	129	703	13.3
1	129	129	710	18.6
1	129	129	712	11.2
1	129	129	713	22.2
2	101	101	501	30.4
2	101	101	510	127.4
2	101	101	515	84.8
2	102	102	501	5.2
2	102	102	510	44.5
2	102	102	515	24.0
2	103	103	501	96.0
2	103	103	504	32.0
2	103	103	510	97.6
2	103	103	514	60.0
2	103	103	515	53.2
2	104	104	509	36.3
2	104	104	510	12.3
2	104	104	514	60.0
2	105	105	504	34.0
2	105	105	505	6.1
2	105	105	508	74.5
2	105	105	510	44.0
2	105	105	514	16.0
2	106	106	504	35.0
2	106	106	505	46.5
2	106	106	508	47.0
2	106	106	510	60.0
2	106	106	514	49.6
2	107	107	507	26.0
2	107	107	514	32.0
2	108	108	506	12.0
2	108	108	507	4.0
2	108	108	513	13.0
2	109	109	502	2.2
2	109	109	505	40.0
2	109	109	507	30.0
2	109	109	513	32.0
2	110	110	502	16.7
2	110	110	506	40.5
2	110	110	507	15.3
2	110	110	513	36.0
2	111	111	502	64.0
2	111	111	506	124.0
2	111	111	507	60.0
2	112	112	502	48.0
2	112	112	506	24.3
2	112	112	507	30.0
2	112	112	514	32.0
2	113	113	502	54.0
2	113	113	505	14.0
2	113	113	506	25.0
2	113	113	507	17.1
2	113	113	513	8.0
2	114	114	503	0.1
2	114	114	511	23.7
2	114	114	513	27.3
2	115	115	503	17.6
2	115	115	511	46.0
2	115	115	513	100.1
2	116	116	502	44.0
2	116	116	507	39.3
2	116	116	513	48.0
2	117	117	509	40.0
2	117	117	510	68.0
2	117	117	512	57.6
2	117	117	515	60.0
2	118	118	508	0.1 [1]
2	118	118	509	14.0 [2]
2	118	118	510	52.0
2	118	118	512	34.4
2	119	119	.5	52.8
2	119	119	509	9.5
2	119	119	510	24.8
2	119	119	512	44.5
2	119	119	515	36.0
2	120	120	508	42.9
2	120	120	509	14.0
2	120	120	510	37.2
2	120	120	512	11.2
2	120	120	515	76.8
2	121	121	505	56.0
2	121	121	509	38.2
2	121	121	511	30.9

1.) District 118 mod; changed to 57.0 min.
2.) District 118 mod; changed to 4.0 min.

Table XIV

CODE	ORIG		DEST	MIN
	SI	PROC		
2	121	121	512	34.0
2	122	122	506	52.8
2	122	122	508	28.3
2	122	122	510	18.8
2	122	122	512	38.4
2	122	122	515	32.5
2	123	123	506	23.7
2	123	123	508	19.2
2	123	123	510	1.8
2	123	123	512	26.7
2	123	123	514	57.4
2	123	123	515	30.3
2	124	124	505	15.2
2	124	124	506	50.8
2	124	124	508	33.4
2	124	124	510	31.4
2	124	124	511	15.0
2	124	124	512	0.1
2	125	125	505	8.8
2	125	125	506	33.6
2	125	125	508	36.0
2	125	125	511	11.7
2	125	125	512	20.0
2	126	126	505	11.0
2	126	126	506	14.4
2	126	126	508	10.9
2	126	126	514	32.9
2	127	127	505	25.5
2	127	127	506	28.4
2	127	127	508	19.2
2	127	127	510	15.9
2	127	127	512	10.7
2	128	128	505	7.2
2	128	128	506	0.1
2	128	128	508	20.0
2	128	128	514	33.1
2	129	129	505	6.7
2	129	129	508	4.0
2	129	129	510	15.9
2	129	129	514	19.2
3	501	901	510	60.0
3	501	901	515	21.5
3	502	901	505	25.5
3	502	901	506	27.0
3	502	901	507	10.3
3	502	901	514	59.1
3	503	901	505	29.8
3	503	901	507	40.0
3	503	901	513	35.0
3	503	901	514	98.0
3	504	901	506	67.8
3	504	901	510	67.9
3	504	901	514	46.2
3	505	901	506	13.3
3	505	901	510	31.9
3	505	905	606	13.3
3	505	901	514	39.0
3	505	905	610	31.9
3	505	905	614	39.0
3	506	901	505	13.2
3	506	901	510	32.0
3	506	901	514	34.2
3	506	905	605	13.3
3	506	905	610	32.0
3	506	905	614	34.2
3	507	901	505	10.3
3	507	901	506	20.0
3	507	901	510	35.0
3	507	901	514	47.1
3	507	905	605	10.3
3	507	905	606	20.0
3	507	905	610	36.0
3	507	905	614	47.9
3	508	901	505	15.5
3	508	901	506	19.2
3	508	901	510	15.4
3	508	901	514	31.5
3	509	901	505	43.5
3	509	901	506	60.0
3	509	901	508	49.0
3	509	901	510	52.2
3	509	901	512	26.0
3	509	901	515	72.0
3	510	901	505	31.9
3	510	901	506	32.0
3	510	901	514	36.0
3	510	905	605	31.9
3	510	905	606	32.0
3	510	905	614	36.0
3	511	901	505	38.2
3	511	901	506	37.6

Table XIV

CODE	ORIG		DEST	MIN
	SI	PROC		
3	511	901	510	52.3
3	511	901	512	21.0
3	511	901	514	54.3
3	514	905	606	34.2
3	514	905	610	35.0
3	515	905	610	40.0
4	501	901	701	41.6
4	501	901	702	17.6
4	501	901	703	60.0
4	502	901	706	44.0
4	502	901	707	12.0
4	502	901	709	77.9
4	503	901	705	10.9
4	503	901	706	18.2
4	503	901	709	12.0
4	504	901	704	26.4
4	504	901	710	36.0
4	504	901	712	51.3
4	505	901	703	31.9
4	505	901	704	18.2
4	505	901	712	33.6
4	505	901	713	21.3
4	505	905	703	31.9
4	505	905	705	18.2
4	505	905	712	33.6
4	505	905	713	21.8
4	506	901	703	32.0
4	506	901	706	34.2
4	506	901	712	15.9
4	506	901	713	23.9
4	506	905	703	32.0
4	506	905	706	34.2
4	506	905	712	15.9
4	506	905	713	23.9
4	507	901	706	39.0
4	507	901	707	11.9
4	507	901	709	40.5
4	507	905	705	30.6
4	507	905	707	11.9
4	507	905	709	40.0
4	508	901	703	15.6
4	508	901	706	40.0
4	508	901	712	36.6
4	508	901	713	13.5
4	509	901	703	45.8
4	509	901	711	25.5
4	509	901	713	39.0
4	510	901	702	42.0
4	510	901	703	0.1
4	510	901	711	34.2
4	510	901	712	33.6
4	510	901	713	23.9
4	510	905	702	42.0
4	510	905	703	0.1
4	510	905	711	34.2
4	510	905	712	33.6
4	510	905	713	23.5
4	511	901	705	18.0
4	511	901	706	3.9
4	511	901	711	28.0
4	511	901	713	34.2
4	514	905	703	35.0
4	514	905	704	34.2
4	514	905	710	17.1
4	514	905	712	4.6
4	515	905	702	24.3
4	515	905	703	40.0
5	501	903	514	-0.1
5	501	903	515	-0.1
5	503	903	514	-0.1
5	503	903	515	-0.1
5	504	903	514	-0.1
5	504	903	515	-0.1
5	505	903	514	-0.1
5	505	903	515	-0.1
5	505	905	605	-0.1
5	506	903	514	-0.1
5	506	903	515	-0.1
5	506	905	606	-0.1
5	507	903	514	-0.1
5	507	903	515	-0.1
5	507	905	607	-0.1
5	508	903	514	-0.1
5	508	903	515	-0.1
5	509	902	514	9.8
5	509	902	515	9.9
5	510	903	514	-0.1
5	510	903	515	-0.1
5	510	905	610	-0.1
5	511	902	514	7.3

Table XIV

CORF	ORIG		DEST	MIN
	SI	PROC		
5	511	902	515	7.3
5	512	903	514	-0.1
5	512	903	515	-0.1
5	513	903	514	-0.1
5	513	903	515	-0.1
5	514	905	514	-0.1
5	515	905	515	-0.1

Table XV

Page 1 of 2

TRANSPORTATION FILE, ST. LOUIS C

CODE	ORIG		DEST	MIN
	SI	PROC		
2	101	101	501	30.4
2	101	101	510	127.4
2	102	102	501	5.2
2	102	102	510	44.5
2	103	103	501	96.0
2	103	103	504	32.0
2	103	103	510	97.6
2	104	104	508	36.8
2	104	104	510	12.8
2	105	105	504	34.0
2	105	105	506	6.1
2	105	105	508	74.5
2	105	105	510	44.0
2	106	106	504	36.0
2	106	106	506	46.5
2	106	106	508	47.8
2	106	106	510	60.0
2	107	107	507	26.0
2	108	108	507	4.0
2	109	109	502	2.2
2	109	109	507	30.0
2	110	110	502	16.7
2	110	110	507	15.3
2	111	111	502	64.0
2	111	111	507	60.0
2	112	112	502	49.0
2	112	112	507	30.0
2	113	113	502	64.0
2	113	113	507	17.1
2	114	114	503	0.1
2	115	115	503	17.6
2	116	116	502	44.0
2	116	116	507	39.3
2	117	117	509	40.0
2	117	117	510	68.0
2	118	118	508	3.1 [1]
2	118	118	509	14.0 [2]
2	118	118	510	52.0
2	119	119	509	9.5
2	119	119	510	24.9
2	120	120	508	42.8
2	120	120	509	14.0
2	120	120	510	37.2
2	121	121	505	56.0
2	121	121	509	33.2
2	121	121	511	30.9
2	122	122	506	52.9
2	122	122	508	23.3
2	122	122	510	10.9
2	123	123	506	23.7
2	123	123	508	19.2
2	123	123	510	1.9
2	124	124	505	15.2
2	124	124	506	50.3
2	124	124	508	39.4
2	124	124	510	31.4
2	124	124	511	15.0
2	125	125	505	9.3
2	125	125	506	33.6
2	125	125	508	35.0
2	125	125	511	11.7
2	126	126	505	11.0
2	126	126	506	14.4
2	126	126	508	10.9
2	127	127	505	25.5
2	127	127	506	22.4
2	127	127	508	18.2
2	127	127	510	15.9
2	128	128	505	7.2
2	128	128	506	0.1
2	128	128	508	20.0
2	129	129	506	6.7
2	129	129	508	4.0
2	129	129	510	15.9
3	501	901	510	60.0
3	502	901	507	10.8
3	503	901	507	40.0
3	504	901	506	67.9
3	504	901	510	67.8
3	505	901	506	13.3
3	505	901	510	31.9
3	505	905	606	13.3
3	505	905	610	31.9
3	506	901	505	13.3
3	506	901	510	32.0
3	506	905	605	13.3
3	506	905	610	32.0
3	508	901	505	15.5
3	508	901	506	19.2
3	508	901	510	15.6

1.) District 118 mod; changed to 57.0 min.
2.) District 118 mod; changed to 4.0 min.

Table XV

CODE	ORIG		DEST	MIN
	SI	PROC		
3	509	901	505	43.5
3	509	901	506	60.0
3	509	901	510	52.2
3	510	901	505	31.9
3	510	901	506	32.0
3	510	905	605	31.9
3	510	905	606	32.0
3	511	901	505	39.2
3	511	901	506	37.6
3	511	901	510	63.3
5	505	905	605	-0.1
5	506	905	606	-0.1
5	507	905	607	-0.1
5	510	905	610	-0.1

Table XVI

Page 1 of 3

TRANSPORTATION FILE, ST. LOUIS F

CODE	ORIG		DEST	MIN
	SI	PROC		
2	101	101	501	30.4
2	101	101	510	127.4
2	101	101	515	84.8
2	102	102	501	5.2
2	102	102	510	44.5
2	102	102	515	24.0
2	103	103	501	96.0
2	103	103	504	32.0
2	103	103	510	97.6
2	103	103	514	60.0
2	103	103	515	53.2
2	104	104	508	36.8
2	104	104	510	12.8
2	104	104	514	60.8
2	105	105	504	34.0
2	105	105	504	6.1
2	105	105	508	74.5
2	105	105	510	44.0
2	105	105	514	16.0
2	106	106	504	36.0
2	106	106	506	46.5
2	106	106	508	47.8
2	106	106	510	60.0
2	106	106	514	49.6
2	107	107	507	26.0
2	107	107	514	32.0
2	108	108	506	12.0
2	108	108	507	4.0
2	108	108	513	18.0
2	109	109	502	2.2
2	109	109	506	40.0
2	109	109	507	30.0
2	109	109	513	32.0
2	110	110	502	16.7
2	110	110	506	40.5
2	110	110	507	15.3
2	110	110	513	36.0
2	111	111	502	64.0
2	111	111	506	124.0
2	111	111	507	60.0
2	112	112	502	48.0
2	112	112	506	24.3
2	112	112	507	30.0
2	112	112	514	32.0
2	113	113	502	54.0
2	113	113	505	14.0
2	113	113	506	25.0
2	113	113	507	17.1
2	113	113	513	8.0
2	114	114	503	0.1
2	114	114	511	23.7
2	114	114	513	27.3
2	115	115	503	17.6
2	115	115	511	46.0
2	115	115	513	100.1
2	116	116	502	44.0
2	116	116	507	39.3
2	116	116	513	49.0
2	117	117	509	40.0
2	117	117	510	60.0
2	117	117	512	57.6
2	117	117	515	60.0
2	118	118	508	0.1[1]
2	118	118	509	14.0[2]
2	118	118	510	52.0
2	118	118	512	34.4
2	118	118	515	52.8
2	119	119	509	9.5
2	119	119	510	24.3
2	119	119	512	44.5
2	119	119	515	36.0
2	120	120	508	42.0
2	120	120	509	14.0
2	120	120	510	37.2
2	120	120	512	11.2
2	120	120	515	76.8
2	121	121	505	56.0
2	121	121	509	38.2
2	121	121	511	30.9
2	121	121	512	34.0
2	122	122	506	52.8
2	122	122	508	23.8
2	122	122	510	18.8
2	122	122	512	38.4
2	122	122	515	32.5
2	123	123	506	23.7
2	123	123	508	19.2
2	123	123	510	1.8
2	123	123	512	26.7
2	123	123	514	57.4

1.) District 118 mod; changed to 57.0 min.
2.) District 118 mod; changed to 4.0 min.

Table XVI

CODE	ORIG		DEST	MIN
	SI	PROC		
2	123	123	515	30.3
2	124	124	505	15.2
2	124	124	506	50.8
2	124	124	509	39.4
2	124	124	510	31.4
2	124	124	511	15.0
2	124	124	512	0.1
2	125	125	505	8.8
2	125	125	506	33.6
2	125	125	508	36.0
2	125	125	511	11.7
2	125	125	512	20.0
2	126	126	505	11.0
2	126	126	506	14.4
2	126	126	508	10.9
2	126	126	514	32.9
2	127	127	505	25.5
2	127	127	506	29.4
2	127	127	508	18.2
2	127	127	510	15.9
2	127	127	512	10.7
2	128	128	505	7.2
2	129	128	506	0.1
2	128	128	508	20.0
2	128	128	514	33.1
2	129	129	506	6.7
2	129	129	508	4.0
2	129	129	510	15.9
2	129	129	514	19.2
3	501	901	510	60.0
3	501	901	515	21.6
3	502	901	505	25.5
3	502	901	506	27.0
3	502	901	507	10.8
3	502	901	514	58.1
3	503	901	505	29.8
3	503	901	507	40.0
3	503	901	513	36.0
3	503	901	514	88.0
3	504	901	506	67.8
3	504	901	510	67.5
3	504	901	514	46.2
3	505	901	506	13.3
3	505	901	510	31.9
3	505	901	514	39.0
3	506	901	505	13.3
3	506	901	510	37.0
3	506	901	514	34.2
3	507	901	505	10.3
3	507	901	506	20.0
3	507	901	510	36.0
3	507	901	514	47.1
3	508	901	505	15.4
3	508	901	506	19.2
3	508	901	510	15.4
3	508	901	514	31.5
3	509	901	505	43.5
3	509	901	506	60.0
3	509	901	508	49.0
3	509	901	510	52.2
3	509	901	512	24.0
3	509	901	515	72.0
3	510	901	505	31.9
3	510	901	506	32.0
3	510	901	515	40.0
3	511	901	505	38.2
3	511	901	506	37.6
3	511	901	510	63.3
3	511	901	512	21.0
3	511	901	514	54.3
3	514	905	606	34.2
3	514	905	610	36.0
3	515	905	610	40.0
5	501	903	514	-0.1
5	501	903	515	-0.1
5	503	903	514	-0.1
5	503	903	515	-0.1
5	504	903	514	-0.1
5	504	903	515	-0.1
5	505	903	514	-0.1
5	505	903	515	-0.1
5	506	903	514	-0.1
5	506	903	515	-0.1
5	507	903	514	-0.1
5	507	903	515	-0.1
5	508	903	514	-0.1
5	508	903	515	-0.1
5	509	902	514	9.8
5	509	902	515	9.5
5	510	903	514	-0.1

Table XVI Page 3 of 3

CODE	ORIG		DEST	MIN
	SI	PROC		
5	510	903	515	-0.1
5	511	902	514	7.3
5	511	902	515	7.3
5	512	903	514	-0.1
5	512	903	515	-0.1
5	513	903	514	-0.1
5	513	903	515	-0.1
5	514	905	514	-0.1
5	515	905	615	-0.1

Table XVII　　Page 1 of 2

TRANSPORTATION FILE, ST. LOUIS F-1

CODE	ORIG		DEST	MIN
	SI	PROC		
2	101	101	501	20.4
2	101	101	515	84.0
2	102	102	501	5.2
2	102	102	515	24.0
2	103	103	504	32.0
2	103	103	515	53.2
2	104	104	509	36.9
2	104	104	510	12.8
2	105	105	504	34.0
2	105	105	506	6.1
2	105	105	514	16.0
2	106	106	504	35.0
2	106	106	506	46.5
2	106	106	514	49.6
2	107	107	507	26.0
2	107	107	514	32.0
2	108	108	505	12.0
2	108	108	507	4.0
2	108	108	513	15.0
2	109	109	502	2.2
2	109	109	507	30.0
2	110	110	502	16.7
2	110	110	507	15.3
2	111	111	502	64.0
2	111	111	507	60.0
2	112	112	506	24.3
2	112	112	507	30.0
2	113	113	505	14.0
2	113	113	507	17.1
2	114	114	503	0.1
2	114	114	511	23.7
2	114	114	513	27.3
2	115	115	503	17.6
2	115	115	511	46.0
2	115	115	513	100.1
2	116	116	507	39.3
2	116	116	513	49.0
2	117	117	515	60.0
2	118	118	509	4.0
2	118	118	512	24.4
2	118	118	515	52.6
2	119	119	509	9.5
2	119	119	515	36.0
2	120	120	509	14.0
2	120	120	512	11.2
2	120	120	515	76.0
2	121	121	509	38.2
2	121	121	512	34.0
2	122	122	510	19.8
2	122	122	515	22.5
2	123	123	510	1.6
2	123	123	515	70.3
2	124	124	510	31.4
2	124	124	512	0.1
2	125	125	505	8.6
2	125	125	511	11.7
2	126	126	505	11.0
2	126	126	506	14.4
2	126	126	509	10.6
2	127	127	510	15.9
2	127	127	512	10.7
2	128	128	506	0.1
2	128	128	503	20.0
2	128	128	514	23.1
2	129	129	506	5.7
2	129	129	508	4.0
2	129	129	510	15.9
2	129	129	514	19.2
3	501	901	515	21.6
3	502	901	507	10.2
3	502	901	514	58.1
3	503	901	505	29.3
3	503	901	507	43.0
3	504	901	505	67.9
3	504	901	510	67.8
3	504	901	514	48.2
3	505	901	514	39.0
3	505	901	515	67.3
3	506	901	514	34.2
3	506	901	515	50.0
3	507	901	514	47.1
3	507	901	515	69.9
3	508	901	505	15.6
3	508	901	506	19.2
3	508	901	514	31.9
3	508	901	515	66.0
3	509	901	510	52.2
3	509	901	512	26.0
3	509	901	515	72.0
3	510	901	514	36.0

Table XVII

Page 2 of 2

CODE	ORIG		DEST	MIN
	SI	PROC		
3	510	901	515	40.0
3	511	901	505	38.2
3	511	901	512	21.0
3	511	901	514	54.3
3	514	905	610	36.0
3	515	905	610	40.0
5	503	903	514	-0.1
5	503	903	515	-0.1
5	504	903	514	-0.1
5	504	903	515	-0.1
5	505	903	514	-0.1
5	505	903	515	-0.1
5	506	903	514	-0.1
5	506	903	515	-0.1
5	507	903	514	-0.1
5	507	903	515	-0.1
5	508	903	514	-0.1
5	508	903	515	-0.1
5	509	902	514	9.8
5	509	902	515	9.8
5	510	903	514	-0.1
5	510	903	515	-0.1
5	511	902	514	7.3
5	511	902	515	7.3
5	512	903	514	-0.1
5	512	903	515	-0.1
5	513	903	514	-0.1
5	513	903	515	-0.1
5	514	905	614	-0.1
5	515	905	615	-0.1

Table XVIII

Page 1 of 1

TRANSPORTATION FILE FOR ST. LOUIS G

CODE	ORIG		DEST	MIN
	SI	PROC		
1	103	103	711	48.0
1	105	105	711	14.3
1	108	108	711	25.0
2	101	101	501	6.0
2	102	102	506	45.0
2	102	102	510	52.0
2	102	102	514	25.0
2	103	103	506	47.2
2	103	103	507	43.0
2	104	104	506	28.0
2	104	104	507	29.0
2	105	105	506	51.8
2	105	105	509	18.0
2	105	105	510	41.2
2	106	106	506	40.0
2	106	106	507	30.0
2	107	107	506	12.0
2	108	108	506	23.9
2	108	108	510	23.9
3	501	901	506	92.0
3	501	901	510	60.0
3	507	901	506	20.0
3	507	901	510	36.0
3	507	901	514	47.9
3	509	901	506	60.0
3	509	901	510	52.2
3	510	901	506	32.0
3	510	901	514	36.0
4	509	901	711	25.5
4	510	901	711	34.2

Table XIX Page 1 of 3

TRANSPORTATION FILE FOR N. E. MASSACHUSETTS A

CODE	ORIG		DEST	MIN	CODE	ORIG		DEST	MIN	CODE	ORIG		DEST	MIN
	SI	PROC				SI	PROC				SI	PROC		
1	101	101	706	32.2	1	109	109	708	13.9	2	104	104	503	25.2
1	101	101	710	35.1	1	109	109	709	2.0	2	104	104	504	2.0
1	101	101	713	25.9	1	109	109	710	16.8	2	104	104	514	24.9
1	102	102	710	19.0	1	109	109	713	37.9	2	105	105	501	42.8
1	102	102	713	29.2	1	110	110	709	16.8	2	105	105	503	41.4
1	103	103	704	13.7	1	110	110	710	2.0	2	105	105	504	24.7
1	103	103	705	34.0	1	110	110	713	21.0	2	105	105	506	20.7
1	103	103	710	29.4	1	111	111	711	3.2	2	105	105	514	25.1
1	103	103	713	34.4	1	113	113	704	32.5	2	106	106	501	37.7
1	104	104	704	10.5	1	113	113	705	19.6	2	106	106	503	63.4
1	104	104	705	27.6	1	113	113	706	24.4	2	106	106	504	51.5
1	104	104	710	45.1	1	113	113	710	30.5	2	106	106	506	7.5
1	104	104	713	26.0	1	113	113	713	12.3	2	106	106	514	31.0
1	105	105	704	35.2	1	114	114	706	26.5	2	107	107	502	20.4
1	105	105	705	3.8	1	114	114	710	22.6	2	107	107	503	25.4
1	105	105	706	20.7	1	114	114	713	11.5	2	107	107	507	3.7
1	105	105	710	46.3	2	101	101	501	1.4	2	107	107	514	42.7
1	105	105	713	29.1	2	101	101	503	53.1	2	108	108	502	24.9
1	106	106	705	30.1	2	101	101	512	13.9	2	108	108	503	29.9
1	106	106	706	7.5	2	101	101	514	10.7	2	108	108	507	6.7
1	106	106	710	45.4	2	102	102	502	5.0	2	108	108	514	47.3
1	106	106	713	35.2	2	102	102	505	13.3	2	109	109	502	24.9
1	107	107	708	10.3	2	102	102	507	24.9	2	109	109	503	29.9
1	107	107	709	10.3	2	102	102	514	33.5	2	109	109	507	12.2
1	107	107	710	22.3	2	103	103	502	15.1	2	109	109	510	16.8
1	107	107	713	38.4	2	103	103	503	11.2	2	109	109	514	31.8
1	108	108	708	2.0	2	103	103	504	24.7	2	110	110	502	17.5
1	108	108	709	13.3	2	103	103	507	35.3	2	110	110	503	22.5
1	108	108	710	26.0	2	103	103	514	32.4	2	110	110	507	25.3
1	108	108	713	42.9	2	104	104	502	30.0	2	110	110	510	2.0

Reproduced from best available copy.

Table XIX

Page 2 of 3

CODE	ORIG		DEST	MIN
	SI	PROC		
2	110	110	512	32.4
2	110	110	514	24.9
2	111	111	502	25.6
2	111	111	503	25.9
2	111	111	507	37.6
2	111	111	514	52.9
2	112	112	512	26.0
2	113	113	501	27.1
2	113	113	502	35.6
2	113	113	503	39.9
2	113	113	504	22.1
2	113	113	506	24.4
2	113	113	507	50.9
2	113	113	512	21.5
2	113	113	514	10.3
2	114	114	501	22.4
2	114	114	502	32.6
2	114	114	503	37.6
2	114	114	506	[illegible]
2	114	114	507	[illegible]
2	114	114	512	20.9
2	114	114	514	4.3
3	501	901	503	53.5
3	501	901	506	32.6
3	501	901	507	63.3
3	501	901	514	20.2
3	502	901	503	8.2
3	502	901	504	30.0
3	502	901	507	23.3
3	502	901	514	30.3
3	503	905	644	35.3
3	503	905	647	28.3
3	503	925	644	35.3
3	503	925	647	28.3
3	504	901	503	25.2
3	504	901	506	45.0
3	504	901	507	50.2
3	504	901	514	24.9
3	504	905	643	25.2
3	504	905	644	24.9
3	504	905	647	50.2
3	506	901	503	57.9
3	506	901	504	46.0
3	506	901	507	56.0
3	506	901	514	24.5
3	506	905	643	57.9
3	[illegible]	[illegible]	644	24.5
[illegible]	[illegible]	[illegible]	647	56.0
[illegible]	[illegible]	[illegible]	503	23.3
3	507	901	504	50.2
3	507	901	514	42.0
3	507	905	643	28.3
3	507	905	644	42.0
3	510	901	503	22.9
3	510	901	507	24.3
3	510	901	514	24.9
3	512	915	633	52.9
3	512	915	634	23.1
3	512	915	647	51.6
3	514	901	503	35.3
3	514	901	507	42.0
3	514	905	643	35.3
3	514	905	647	42.0
3	514	925	643	35.3
3	514	925	647	42.0
4	501	901	705	45.6
4	501	901	706	32.5
4	501	901	710	36.5
4	502	901	704	20.0
4	502	901	708	24.9
4	502	901	709	24.9
4	502	901	710	17.5
4	502	901	713	26.0
4	502	905	704	15.1
4	503	905	710	22.5
4	503	905	713	30.0
4	503	925	704	15.1
4	503	925	710	22.5
4	503	925	713	30.0
4	504	901	704	10.5
4	504	901	705	28.5
4	504	901	713	26.9
4	504	905	704	10.5
4	504	905	705	29.5
4	504	905	713	26.9
4	506	901	704	45.0
4	506	901	705	24.5
4	506	901	706	2.0
4	506	901	713	30.7
4	506	905	704	45.0
4	506	905	705	24.5

Table XIX Page 3 of 3

CODE	ORIG SI	ORIG PROC	DEST	MIN
4	506	905	706	2.0
4	506	905	713	30.7
4	507	901	704	40.1
4	507	901	708	5.7
4	507	901	709	12.2
4	507	901	710	25.5
4	507	901	713	41.4
4	507	905	704	40.1
4	507	905	708	5.7
4	507	905	709	12.2
4	507	905	710	25.5
4	507	905	713	41.4
4	510	901	704	26.0
4	510	901	708	16.9
4	510	901	710	7.0
4	510	901	713	21.0
4	514	901	704	35.5
4	514	901	705	27.9
4	514	901	706	24.9
4	514	901	710	24.7
4	514	901	713	9.2
4	514	905	704	35.4
4	514	905	705	27.4
4	514	905	706	24.5
4	514	905	710	24.3
4	514	905	713	9.2
4	514	925	704	35.4
4	514	925	705	27.7
4	514	925	706	24.5
4	514	925	710	24.5
4	514	925	713	9.2
5	503	905	643	-0.1
5	503	925	643	-0.1
5	507	905	647	-0.1
5	512	915	712	-0.1
5	514	905	644	-0.1
5	514	925	644	-0.1
5	633	936	605	-0.1
5	634	936	614	-0.1
5	637	936	607	-0.1
5	643	946	603	-0.1
5	644	946	614	-0.1
5	647	946	607	-0.1

Table XX

TRANSPORTATION FILE FOR N. E. MASSACHUSETTS RUNS EXCEPT A

CODE	ORIGIN	PROCESS	SITE DEST	MIN
2	101	101	501	1.40
2	101	101	514	16.70
2	102	102	502	6.00
2	102	102	503	13.00
2	102	102	514	55.50
2	103	103	502	15.10
2	103	103	503	11.20
2	103	103	514	32.40
2	104	104	503	26.20
2	104	104	504	2.00
2	104	104	514	24.90
2	105	105	502	41.40
2	105	105	504	24.70
2	105	105	506	20.70
2	105	105	514	26.10
2	106	106	503	63.40
2	106	106	504	51.50
2	106	106	506	7.50
2	106	106	514	31.00
2	107	107	502	20.40
2	107	107	503	25.40
2	107	107	507	6.70
2	108	108	503	29.90
2	108	108	507	6.70
2	108	108	514	47.30
2	109	109	503	29.90
2	109	109	507	12.20
2	109	109	510	16.80
2	109	109	514	31.80
2	110	110	502	17.50
2	110	110	503	22.50
2	110	110	510	2.00
2	110	110	514	24.90
2	111	111	502	25.60
2	111	111	503	25.90
2	111	111	507	37.90
2	112	112	512	20.00
2	113	113	503	39.30
2	113	113	504	22.10
2	113	113	506	24.40
2	113	113	514	10.30
2	114	114	503	37.60
2	114	114	507	48.00
2	114	114	514	4.30
3	501	901	503	53.50
3	501	901	506	32.60
3	501	901	507	63.80
3	501	901	514	20.20
3	502	901	503	8.20
3	502	901	504	30.00

CODE	ORIGIN	PROCESS	SITE DEST	MIN
3	502	901	507	22.30
3	502	901	514	30.30
3	503	905	644	35.30
3	503	905	647	28.30
3	503	925	644	35.30
3	503	925	647	26.30
3	504	901	503	26.20
3	504	901	506	46.00
3	504	901	507	50.20
3	504	901	514	24.90
3	504	905	643	26.20
3	504	905	644	24.90
3	504	905	647	50.20
3	505	901	503	57.90
3	506	901	504	46.00
3	506	901	507	56.00
3	505	901	514	24.50
3	505	905	643	57.90
3	506	905	644	24.50
3	506	905	647	56.00
3	507	901	503	28.30
3	507	901	504	50.20
3	507	901	514	42.00
3	507	905	643	28.30
3	507	905	644	42.00
3	510	901	503	22.50
3	510	901	507	24.30
3	510	901	514	24.80
3	512	915	633	52.90
3	512	915	634	23.10
3	512	915	637	51.60
3	514	901	503	35.30
3	514	901	507	42.00
3	514	905	643	35.30
3	514	905	647	42.00
3	514	925	643	35.30
3	514	925	647	42.00
5	503	905	643	-0.10
5	503	925	643	-0.10
5	507	905	647	-0.10
5	514	905	644	-0.10
5	514	925	644	-0.10
5	633	935	603	-0.10
5	634	936	614	-0.10
5	637	936	607	-0.10
5	643	946	603	-0.10
5	644	946	614	-0.10
5	647	946	607	-0.10

Reproduced from
best available copy.

The average payload of a packer truck in all runs was 5 tons (enters into truck constraints).

The average payload of a van in all runs was 17 tons (enters into truck constraints).

In the dynamic run (St. Louis G) the inflation rate was 6% (entered as 1.06) and the discount rate was also 6% (entered as 1/1.06, or .943).

In the three CROW-FLY runs of the Massachusetts exercise program, the factor, nautical miles per minute of longitude, was .75. The average speeds were 45 mph (run C-1); 20 mph (run C-2) and 10 mph (run C-3). One additional run was executed through the front-end only to test CROW-FLY mode 2 (maximum radius). For this run, in which the generated transportation file is presented in Section 5 of this volume, the following assumptions pertain:

1. The basic input deck was the N.E. Massachusetts run A deck, except:
    a. process 907 was added at site 712
    b. process 917 was added at site 711
    c. the provided transportation file included only the type 5 transportation activities of N.E. Massachusetts run A.
2. The factor, nautical miles per minute of longitude was .75.
3. The maximum radius was 15 miles
4. The average speed was 45 mph.

CHAPTER 4

PROCESS OPTIONS AND SELECTIONS FOR THE OPERATIONAL TEST AND EXERCISE PROGRAMS

This section presents single page run summaries for each of the 22 operational test and exercise program runs, focusing on the processing options offered and selected. These are figures 21 through 41.

In the static runs (i.e., all runs except St. Louis G) the processing options are site, process and linear segment,* and the selections are activity levels (and linear segment selected in parentheses). For clarity, the selected site-process is boxed.

System cost in thousands of dollars per year and average cost per ton are included.

All active constraints are identified.

In the dynamic run (St. Louis G) processing options are site, process, linear segment, and time period for capital building or for underutilization, and the selections are activity levels (and linear segment selected in parentheses). In the dynamic run, the selected time period has been boxed for clarity.

---

* A linear segment of 13 means 1 through 3.

Preceding page blank

Figure 21

ST. LOUIS A: THE BASE CASE (TRUCK-HAUL OF FUEL) RUN SUMMARY

90 ROWS 325 COLUMNS + 9 SLACKS PHASE 3 SOLUTION OBJECTIVE VALUE*: 3123.97856 AVERAGE $/TON: 1.25260

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	13	37.9	(1)	508	$\boxed{901}$	13	258.8	(3)
	903	13				903	13		
502	$\boxed{901}$	13	86.9	(2)	509	$\boxed{901}$	13	87.3	(2)
503	$\boxed{901}$	13	165.2	(3)		902	13		
	903	13			510	901	13		
504	$\boxed{901}$	13	4.5	(1)		903	13		
	903	13				$\boxed{905}$	13	220.5	(2)
505	901	13			610	906	13		
	903	13			511	901	13		
	$\boxed{905}$	13	1056.0	(3)		902	13		
605	$\boxed{906}$	13	324.2	(2)	512	903	13		
506	901	13			513	903	13		
	903	13			514	905	13		
	$\boxed{905}$	13	725.4	(2)	614	906	13		
606	906	13			515	905	13		
507	901	13			615	906	13		
	903	13			703	907	13		
	$\boxed{905}$	13	492.1	(2)	706	907	13		
607	906	13							

ACTIVE CONSTRAINTS: TRUCK CONSTRAINT, 505/605 TRUCK CONSTRAINT, 506/606

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 22

ST. LOUIS A-1: OFF-SITE PROCESSING (RAIL-HAUL OF FUEL) **RUN SUMMARY**

62 ROWS 167 COLUMNS + 3 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: 3599.86506 AVERAGE $/TON: 1.44341

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	12	37.9	(1)	507	901	23	502.0	
502	$\boxed{901}$	13	86.9	(2)		$\boxed{905}$	13		
503	$\boxed{901}$	23	165.2	(3)	60.	906	12	395.2	(3)
504	$\boxed{901}$	12	4.5	(1)	508	$\boxed{901}$	23	87.3	(2)
505	901	23			509	$\boxed{901}$	12	153.5	
	$\boxed{905}$	13	1240.0	(3)	510	$\boxed{901}$	13		
605	$\boxed{906}$	12	324.2	(2)		905	13		
506	901	23			610	906	12		
	$\boxed{905}$	13	752.0	(2)	511	901	12		
606	906	12							

ACTIVE CONSTRAINTS: TRUCK CONSTRAINT, 505/605 TRUCK CONSTRAINT, 506/606

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 23

ST. LOUIS B: LANDFILL ADDED (TRUCK-HAUL OF FUEL) and B-1, LANDFILL ADDED (RAIL-HAUL OF FUEL) RUN SUMMARIES

112 ROWS, 512 COLUMNS + 20 SLACKS, PHASE 3 SOLUTIONS

B: OBJECTIVE VALUE:* 3115.66636 AVERAGE $/TON: 1.249266

B-1: OBJECTIVE VALUE:* 4007.72956 AVERAGE $/TON: 1.60695

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	13	37.9	(1)	511	901	13		
	903	13				902	13		
502	$\boxed{901}$	13	86.9	(2)	512	903	13		
503	$\boxed{901}$	13	165.2	(3)	513	903	13		
	903	13			514	905	13		
504	$\boxed{901}$	13	4.5	(1)	614	906	13		
	903	13			515	905	13		
505	901	13			615	906	13		
	903	13			701	907	13		
	$\boxed{905}$	13	1056.0	(3)	702	907	13		
605	$\boxed{906}$	13	322.6	(2)	703	907	13		
506	901	13			704	907	13		
	903	13			705	907	13		
	$\boxed{905}$	13	725.4	(2)	706	907	13		
606	906	13			707	907	13		
507	901	13			708	$\boxed{907}$	13	12.1	(1)
	903	13			709	907	13		
	$\boxed{905}$	13	480.0	(2)	710	907	13		
607	906	13			711	907	13		
508	$\boxed{901}$	13	258.2	(3)	712	907	13		
	903	13			713	907	13		
509	901	13	87.3	(2)					
	902	13							
510	901	13							
	903	13							
	$\boxed{905}$	13	220.5						
610	906	13							

ACTIVE CONSTRAINTS: TRUCK CONSTRAINT, 505/605 TRUCK CONSTRAINT, 506/606

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 24

ST. LOUIS C: NO INTERSTATE FLOWS (RAIL-HAUL OF FUEL) RUN SUMMARY

61 ROWS 146 COLUMNS + 3 SLACKS PHASE 3 SOLUTION OBJECTIVE VALUE:* 4586.66967 AVERAGE$/TON 1.839083

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	12	37.9	(1)	507	$\boxed{905}$	13	667.2	(2)
502	$\boxed{901}$	13	86.9	(2)	607	$\boxed{906}$	12	86.7	(1)
503	$\boxed{901}$	23	165.2	(3)	508	$\boxed{901}$	23	541.9	(3)
504	$\boxed{901}$	12	4.5	(1)	509	$\boxed{901}$	12	86.2	(2)
505	$\boxed{901}$	23	579.5	(3)	510	901	13		
	905	13				$\boxed{905}$	13	253.1	
605	906	12			610	906	12		
506	901	23							
	$\boxed{905}$	13	1573.7	(3)					
606	$\boxed{906}$	12	237.5	(2)					

ACTIVE CONSTRAINTS: TRUCK CONSTRAINT, 505/605 TRUCK CONSTRAINT, 506/606

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 25

ST. LOUIS E: HALF COMMERCIAL TONNAGE (RAIL-HAUL OF FUEL) RUN SUMMARY

62 ROWS 167 COLUMNS + 3 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE:* 3703.10966 AVERAGE $/TON: 1.752455

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	901	12	34.0	(1)	507	901	23		
502	901	13	74.9	(2)		905	13	484.5	(2)
503	901	23	150.3	(3)	607	906	12		
504	901	12	4.3	(1)	508	901	23	566.9	(3)
505	901	23			509	901	12	80.2	(2)
	905	13	1499.1	(3)	510	901	13		
605	906	12	274.7	(2)		905	13	129.5	(1)
506	901	23	336.2	(3)	610	906	12		
	905	13			511	901	12		
606	906	12							

ACTIVE CONSTRAINT: TRUCK CONSTRAINT AT 505/605

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 26

ST. LOUIS F: PROCESSING FORCED ON UTILITY SITES (MERAMEC CAPACITY: 624) RUN SUMMARY

75 ROWS 254 COLUMNS+2 SLACKS PHASE 3 SOLUTION OBJECTIVE VALUE*: 4865.9449 AVERAGE $/TON 1.951062

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	12	37.9	(1)	508	901	23		
	903	12				$\boxed{903}$	23	642.4	(3)
502	$\boxed{901}$	13	86.9	(2)	509	$\boxed{901}$	12	35.8	(1)
503	901	23				902	12		
	$\boxed{903}$	23	165.2	(3)	510	$\boxed{901}$	13	57.5	(2)
504	901	12				903	13		
	903	12			510	906	12		
505	901	23			511	901	12		
	$\boxed{903}$	23	434.4	(3)		902	12		
506	901	23			512	$\boxed{903}$	13	282.1	(3)
	$\boxed{902}$	23	404.1	(3)	513	903	13		
506	906	12			514	905	13		
507	901	23			514	906	12		
	$\boxed{902}$	23	388.6	(3)	515	$\boxed{905}$	13	2494.0	(3)
					515	906	12	224.2	(2)

NO ACTIVE CONSTRAINTS

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVEL AND CAPACITY IN THOUSANDS OF TONS PER YEAR

Figure 27

ST. LOUIS F-1: PROCESSING FORCED ON UTILITY SITES (MERAMEC CAPACITY: 1267) RUN SUMMARY

75 ROWS 181 COLUMNS + 4 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: 3955.0481 AVERAGE $/TON: 1.5858

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	12	37.9	(1)	509	$\boxed{901}$	12	36.9	(1)
502	$\boxed{901}$	13	86.9	(2)		902	12		
503	901	23			510	$\boxed{901}$	13	57.5	(2)
	$\boxed{903}$	23	165.2	(3)		903	13		
504	901	12			610	906	12		
	$\boxed{903}$	12			511	901	12		
505	$\boxed{901}$	23	434.4	(3)		902	12		
	903	23			512	$\boxed{903}$	13	262.1	(3)
506	$\boxed{901}$	23	349.7	(3)	513	903	13		
	903	23			514	$\boxed{905}$	13	1267.0	(3)
507	$\boxed{901}$	23	286.8	(3)	614	$\boxed{906}$	12	164.7	(2)
	903	23			515	$\boxed{905}$	13	1227.0	(3)
508	$\boxed{901}$	23	642.4	(3)	615	$\boxed{906}$	12	159.5	(2)
	903	23							

ACTIVE CONSTRAINT: TONNAGE CONSTRAINT AT 514 (MERAMEC PLANT)

*OBJECTIVE VALUE THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS AND CAPACITY IN THOUSANDS OF TONS PER YEAR

Figure 28

ST. LOUIS G: DYNAMIC RUN, GAS PYROLYSIS IN 2ND PERIOD RUN SUMMARY

115 ROWS 287 COLUMNS +2 SLACKS PHASE 3 SOLUTION OBJECTIVE VALUE*: -178939.3750 DISCOUNTED AVERAGE $/TON: -1.890775

SITE	PROCESS	SEGMENT	PERIOD	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	PERIOD	ACTIVITY LEVEL* (SEGMENT)
501	901	13	$\boxed{1}$	K's: 75.9	(2)	514	955	13	1	
			2						2	
			3						3	
			$\boxed{4}$	98.8	(2)				4	
506	935	01	$\boxed{2}$	2226.9	(1)	711	907	13	1	
			$\boxed{3}$	1220.7	(1)				2	
			4						3	
506	955	13	$\boxed{1}$	2466.4	(3)				4	
			2							
			3							
			4							
507	901	13	1			UNDERUTILIZATION (S) ACTIVITIES ARE AVAILABLE FOR EACH SITE PROCESS IN EACH PERIOD; ONLY SELECTED S ACTIVITIES ARE LISTED. SEGMENT DOES NOT APPLY.				
			2							
			3							
			4							
507	935	01	$\boxed{2}$	825.6	(1)					
			3							
			$\boxed{4}$	680.1	(1)					
509	901	13	1			501	901		1	S's: 36.8
			$\boxed{2}$	271.0	(3)					
			3			501	901		2	25.1
			4							
510	901	13	1			506	955		2	2466.4
			2							
			3			506	955		3	2466.4
			4							
510	935	01	2			509	901		2	156.4
			3							
			$\boxed{4}$	407.0	(1)	509	901		3	75.7

NO ACTIVE CONSTRAINTS *OBJECTIVE VALUE IN DISCOUNTED THOUSANDS OF DOLLARS OVER PLANNING PERIOD;

ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR CAPACITY BUILT (K) OR IN THOUSANDS OF TONS PER YEAR UNDERUTILIZED (S).

Figure 29

N.E. MASSACHUSETTS A: THE BASE CASE (ALL OPTIONS) RUN SUMMARY

78 ROWS 313 COLUMNS + 16 SLACKS PHASE 3 SOLUTION: OBJECTIVE VALUE*: 1071.0181 AVERAGE $/TON .879

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	13	189.7	(3)	514	$\boxed{901}$	13	83.9	(2)
502	901	13				905	13		
503	$\boxed{905}$	13	1032.1	(3)		925	13		
	925	13				935	02		
	935	02			614	$\boxed{906}$	13	180.7	(2)
603	906	13			634	$\boxed{936}$	01	46.5	(1)
633	936	01			644	$\boxed{946}$	01	134.2	(1)
643	946	01			704	907	13		
504	$\boxed{901}$	13	55.4	(1)	705	907	13		
	905	13			706	907	13		
	935	01			708	907	13		
506	$\boxed{901}$	13	45.8	(1)	709	907	13		
	905	13			710	907	13		
	935	01			711	907	13		
507	$\boxed{901}$	13	220.8	(3)	712	917	01		
	905	13			713	907	13		
	935	02							
607	906	13							
637	936	01							
647	946	01							
510	$\boxed{901}$	13	108.0	(2)					
512	$\boxed{915}$	12	186.0	(1)					

ACTIVE CONSTRAINTS: NONE

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 30

N.E. MASSACHUSETTS A-2: BASE CASE RUN SUMMARY

60 ROWS 148 COLUMNS + 7 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: 1179.8943 AVERAGE $/TON: .96864

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	23	189.7	(3)	510	$\boxed{901}$	23	108.0	(2)
502	901	23			512	$\boxed{915}$	12	186.0	(1)
503	$\boxed{905}$	23	657.5	(2)	514	$\boxed{901}$	23	83.9	(2)
	925	23				905	23		
	935	02				925	23		
603	906	13				935	02		
633	936	01			614	906	13		
643	946	01			634	936	01		
504	$\boxed{901}$	12	55.4	(1)	644	946	01		
	905	12							
	935	01							
506	$\boxed{901}$	12	45.8	(1)					
	905	12							
	935	01							
507	901	23							
	$\boxed{905}$	23	374.6	(2)					
	935	02							
607	$\boxed{906}$	13	180.7	(2)					
637	$\boxed{936}$	01	46.5	(1)					
647	$\boxed{946}$	01	134.2	(1)					

ACTIVE CONSTRAINTS: NONE

* OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 31

N.E. MASSACHUSETTS A-3: BASE CASE WITH ALL 514 STARTING BASIS RUN SUMMARY

60 ROWS 148 COLUMNS + 7 SLACKS PHASE 3 SOLUTION OBJECTIVE VALUE*: 877.3237 AVERAGE $/TON: .720239

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	23	189.7	(3)	510	$\boxed{901}$	23	108.0	(2)
502	$\boxed{901}$	23	328.5	(3)	512	915	12	186.0	(1)
503	905	23			514	901	23		
	925	23				$\boxed{905}$	23	1032.1	(3)
	935	02				925	23		
603	906	13				935	02		
633	936	01			614	$\boxed{906}$	13	180.7	(2)
643	946	01			634	$\boxed{936}$	01	46.5	(1)
504	$\boxed{901}$	12	43.4	(1)	644	$\boxed{946}$	01	134.2	(1)
	905	12							
	935	01							
506	$\boxed{901}$	12	45.8	(1)					
	905	12							
	935	01							
507	$\boxed{901}$	23	220.8	(3)					
	905	23							
	935	02							
607	906	13							
637	936	01							
647	946	01							

ACTIVE CONSTRAINTS:

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 32

N.E. MASSACHUSETTS A-4: BASE CASE WITH ALL-HAVERHILL STARTING BASIS RUN SUMMARY

60 ROWS 148 COLUMNS + 7 SLACKS PHASE 3 SOLUTION OBJECTIVE VALUE*: 825.0811 AVERAGE $/TON .677351

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	901	23	189.7	(3)	510	901	23	108.0	(2)
502	901	23			512	915	12	186.0	(1)
503	905	23	1032.1	(3)	514	901	23	83.9	(2)
	925	23				905	23		
	935	02				925	23		
603	906	13	180.7	(2)		935	02		
633	936	01	46.5	(1)	614	906	13		
643	946	01	134.2	(1)	634	936	01		
504	901	12	55.4	(1)	644	946	01		
	905	12							
	935	01							
506	901	12	45.8	(1)					
	905	12							
	935	01							
507	901	23	220.8	(3)					
	905	23							
	935	02							
607	906	13							
637	936	01							
647	946	01							

ACTIVE CONSTRAINTS: NONE

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 33

N. E. MASSACHUSETTS B-1: DOUBLE TONNAGE RUN SUMMARY

60 ROWS 148 COLUMNS + 7 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: –1807.6484 AVERAGE $/TON: –.7420

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	901	23	379.4	(3)	510	901	23	216.0	(3)
502	901	23			512	915	12	372.0	(2)
503	905	23	2064.2	(3)	514	901	23	167.8	(3)
	925	23				905	23		
	935	02				925	23		
603	906	13	361.3	(2)		935	02		
633	936	01	93.0	(1)	614	906	13		
643	946	01	268.3	(1)	634	936	01		
504	901	12	110.8	(2)	644	946	01		
	905	12							
	935	01							
506	901	12	91.6	(2)					
	905	12							
	935	01							
507	901	23	441.6	(3)					
	905	23							
	935	02							
607	906	13							
637	936	01							
647	946	01							

ACTIVE CONSTRAINTS: NONE

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 34

N.E. MASSACHUSETTS B-2: HALF-TONNAGE RUN SUMMARY

60 ROWS 148 COLUMNS + 7 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: 1448.4475 AVERAGE $/TON: 2.3788

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	901	23	94.9	(2)	510	901	23	54.0	(2)
502	901	23			512	915	12	93.0	(1)
503	905	23	516.4	(2)	514	901	23	42.0	(2)
	925	23				905	23		
	935	02				925	23		
603	906	13				935	02		
633	936	01			614	906	13		
643	946	01			634	936	01		
504	901	12	27.7	(1)	644	946	01		
	906	12							
	935	01							
506	901	12	22.9	(1)					
	906	12							
	935	01							
507	901	23	110.5	(2)					
	906	23							
	935	02							
607	906	13	90.4	(1)					
637	936	01	23.3	(1)					
647	946	01	67.1	(1)					

ACTIVE CONSTRAINTS: NONE

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 35

N.E. MASSACHUSETTS C-1: CROW-FLY AT 45 M.P.H. **RUN SUMMARY**

60 ROWS 148 COLUMNS + 7 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: –1886.1833 AVERAGE $/TON: –1.5485

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	23	189.7	(3)	510	$\boxed{901}$	23	108.0	(2)
502	901	23			512	$\boxed{915}$	12	186.0	(1)
503	$\boxed{905}$	23	1032.1	(3)	514	$\boxed{901}$	23	72.5	(2)
	925	23				905	23		
	935	02				925	23		
603	906	13				935	02		
633	936	01			614	906	13		
643	946	01			634	936	01		
504	901	12			644	946	01		
	905	12							
	935	01							
506	$\boxed{901}$	12	45.8	(1)					
	905	12							
	935	01							
507	$\boxed{901}$	23	220.8	(3)					
	905	23							
	935	02							
607	$\boxed{906}$	13	180.7	(2)					
637	$\boxed{936}$	01	46.5	(1)					
647	$\boxed{946}$	01	134.2	(1)					

ACTIVE CONSTRAINTS: NONE

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 36

N.E. MASSACHUSETTS C-2: CROW-FLY AT 20 M.P.H. RUN SUMMARY

60 ROWS 148 COLUMNS + 7 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: 289.6099 AVERAGE $/TON: .2378

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	901	23	189.7	(3)	510	901	23	161.4	(3)
502	901	23			512	915	12	186.0	(1)
503	905	23	1032.1	(3)	514	901	23	83.9	(2)
	925	23				905	23		
	935	02				925	23		
603	906	13	180.7	(2)		935	02		
633	936	01	46.5	(1)	614	906	13		
643	946	01	134.2	(1)	634	936	01		
504	901	12	43.4	(1)	644	946	01		
	905	12							
	935	01							
506	901	12	45.8	(1)					
	905	12							
	935	01							
507	901	23	167.4	(3)					
	905	23							
	935	02							
607	906	13							
637	936	01							
647	946	01							

ACTIVE CONSTRAINTS: NONE

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 37

N.E. MASSACHUSETTS C-3: CROW-FLY AT 10 M.P.H. RUN SUMMARY

60 ROWS 148 COLUMNS + 7 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: 3419.1289 AVERAGE $/TON: 2.8069

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	23	189.7	(3)	510	$\boxed{901}$	23	108.0	(2)
502	$\boxed{901}$	23	157.7	(3)	512	$\boxed{915}$	12	186.0	(1)
503	$\boxed{905}$	23	371.9	(2)	514	901	23		
	925	23				$\boxed{905}$	23	439.4	(2)
	935	02				925	23		
603	$\boxed{906}$	13	180.7	(2)		935	02		
633	$\boxed{936}$	01	46.5	(1)	614	906	13		
643	$\boxed{946}$	01	134.2	(1)	634	936	01		
504	$\boxed{901}$	12	43.4	(1)	644	946	01		
	905	12							
	935	01							
506	$\boxed{901}$	12	45.8	(1)					
	905	12							
	935	01							
507	901	23							
	$\boxed{905}$	23	220.8	(2)					
	935	02							
607	906	13							
637	936	01							
647	946	01							

ACTIVE CONSTRAINTS: NONE

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 38

N.E. MASSACHUSETTS D-1: MODERATE TRUCK CONSTRAINTS RUN SUMMARY

60 ROWS 149 COLUMNS + 7 SLACKS PHASE 3 SOLUTION OBJECTIVE VALUE*: 910.2827 AVERAGE $/TON: .7473

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	23	189.7	(3)	510	$\boxed{901}$	23	108.0	(2)
502	$\boxed{901}$	23	157.7	(3)	512	$\boxed{915}$	12	186.0	(1)
503	$\boxed{905}$	23	1032.1	(3)	514	$\boxed{901}$	23	83.9	(2)
	925	23				905	23		
	935	02				925	23		
603	$\boxed{906}$	13	180.7	(2)		935	02		
633	$\boxed{936}$	01	46.5	(1)	614	906	13		
643	$\boxed{946}$	01	134.2	(1)	634	936	01		
504	$\boxed{901}$	12	55.4	(1)	644	946	01		
	905	12							
	935	01							
506	$\boxed{901}$	12	45.8	(1)					
	905	12							
	935	01							
507	$\boxed{901}$	23	220.8	(3)					
	905	23							
	935	02							
607	906	13							
637	936	01							
647	946	01							

ACTIVE CONSTRAINST: NONE, BUT TRUCK CONSTRAINT AT 503/603/633/643 CAUSED 501/901 TO ENTER THE SOLUTIONS

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 39

N.E. MASSACHUSETTS D-2: TIGHT TRUCK CONSTRAINTS RUN SUMMARY

60 ROWS 149 COLUMNS + 7 SLACKS PHASE 3 SOLUTION OBJECTIVE VALUE*: 3299.3506 AVERAGE $/TON: 2.7086

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	23	189.7	(3)	510	901	23		
502	$\boxed{901}$	23	509.9	(3)	512	$\boxed{915}$	12	166.0	(1)
503	905	23			514	901	23		
	925	23				$\boxed{905}$	23	423.6	(2)
	$\boxed{935}$	02	112.9	(2)		925	23		
603	906	13				935	02		
633	936	01			614	906	13		
643	946	01			634	936	01		
504	$\boxed{901}$	12	43.4	(1)	644	946	01		
	905	12							
	935	01							
506	$\boxed{901}$	12	57.8	(1)					
	905	12							
	935	01							
507	901	23							
	$\boxed{905}$	23	495.6	(2)					
	935	02							
607	$\boxed{906}$	13	166.0	(2)					
637	$\boxed{936}$	01	46.5	(1)					
647	$\boxed{946}$	01	119.5	(1)					

ACTIVE CONSTRAINTS: TRUCK CONSTRAINT, 507/607/637/647; TRUCK CONSTRAINT, 514/614/634/644.

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 40

N.E. MASSACHUSETTS E-1: DOUBLE INTERCEPTS RUN SUMMARY

80 ROWS 148 COLUMNS + 7 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: 1802.0232 AVERAGE $/TON: 1.4794

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	$\boxed{901}$	23	189.7	(3)	510	$\boxed{901}$	23	108.0	(2)
502	901	23			512	$\boxed{915}$	12	186.0	(2)
503	$\boxed{905}$	23	1032.1	(2)	514	$\boxed{901}$	23	83.9	(2)
	925	23				905	23		
	935	02				925	23		
603	$\boxed{906}$	13	180.7			935	02		
633	$\boxed{936}$	01	46.5		614	906	13		
643	$\boxed{946}$	01	134.2		634	936	01		
504	$\boxed{901}$	12	55.4	(1)	644	946	01		
	905	12							
	935	01							
506	$\boxed{901}$	12	45.8	(1)					
	905	12							
	935	01							
507	$\boxed{901}$	23	220.8	(3)					
	905	23							
	935	02							
607	906	13							
637	936	01							
647	946	01							

ACTIVE CONSTRAINTS: NONE

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

Figure 41

N.E. MASSACHUSETTS E-2: HALF INTERCEPTS RUN SUMMARY

80 ROWS 14 COLUMNS + 7 SLACKS PHASE 4 SOLUTION OBJECTIVE VALUE*: -622.7158 AVERAGE $/TON: -.5112

SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)	SITE	PROCESS	SEGMENT	ACTIVITY LEVEL*	(SEGMENT)
501	901	23	189.7	(3)	510	901	23	108.0	(2)
502	901	23			512	915	12	186.0	(2)
503	905	23	1032.1	(3)	514	901	23	83.9	(2)
	925	23				905	23		
	935	02				925	23		
603	906	13	180.7	(2)		935	02		
633	936	01	46.5	(1)	614	906	13		
643	946	01	134.2	(1)	634	936	01		
504	901	12	55.4	(1)	644	946	01		
	905	12							
	935	01							
506	901	12	45.8	(1)					
	905	12							
	935	01							
507	901	23	220.8	(3)					
	905	23							
	935	02							
607	906	13							
637	936	01							
647	946	01							

ACTIVE CONSTRAINTS: NONE

*OBJECTIVE VALUE IN THOUSANDS OF DOLLARS PER YEAR ACTIVITY LEVELS IN THOUSANDS OF TONS PER YEAR

CHAPTER 5

OUTPUTS OF OPERATIONAL TEST AND EXERCISE PROGRAM RUNS

Tables XXI through XLII display the results of the 9 operational test runs, the 13 exercise program runs, and the front-end-only CROW-FLY mode 2 (maximum radius) run.

Inputs and other assumptions have been described in Chapter 3. Summaries of process options offered and selected for each run have been presented in Chapter 4, together with last phase of solution, the number of rows, the number of columns, the solution values, and the active constraints for each run.

Running time experience has been presented in Chapter 6 of the User's Guide.

The presentation in this section includes all activity levels, the objective values (total system cost) and the average costs per ton for each solution.

The WRAP post processor was not operational for all of the runs. Where it has been available, it has been used to provide the interpretation of the solution. In three runs (N.E. Massachusetts A, A-2, and A-3), the post processor was not available, and the solution was interpreted by hand.

Table XXIII includes solutions for both St. Louis B and St. Louis B-1 because of the fact that those two runs generated identical activity levels.

The District 118 mod (for which see the subsection Transportation Data in Chapter 3) has been carried out for St. Louis A, A-1, B, B-1, C, E, and F which were all of the runs affected by that problem. In all cases, the solution is shown as generated and as modified.

For static runs, the objective values are in thousands of dollars per year, including all costs from the time the packer trucks are loaded (i.e., cost of haul to first offload point is included). Average costs are on the same basis, and are in thousands of dollars per thousand tons, or dollars per ton. For static runs, acitivity levels are in thousands of tons per year.

For the dynamic run, the objective value is the total discounted and inflated system cost over the whole planning period. The average cost per ton is the objective value divided by total ton-years over the planning period. Activity levels are in thousands of tons per year.

Table XXI
OUTPUTS FOR ST. LOUIS A
(Phase 3 Solution)

Page 1 of 4

Total Tonnage is 2493.9978

	As Computed	District 118 Mod Increment	As Adjusted
Objective Value:	3026.1064	+97.87216	3123.97856
Average Cost Per Ton:	1.213356	+ .03924	1.25260

St. Louis A

Table XXI

Page 2 of 4

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN NAME	DESTINATION NAME			ACTIVITY LEVEL*
DISTRICT 1	[illegible]	#1 TRANS	501	[illegible]
DISTRICT 2	[illegible]	#1 TRANS	501	35.0000
DISTRICT 3	[illegible]	#4 TRANS	504	4.5000
DISTRICT 4	[illegible]	#10 TO TRANS PROCSNG	510	[illegible]
DISTRICT 5	[illegible]	#6 TO TRANS PROCSNG	506	53.7000
DISTRICT 6	[illegible]	#6 TO TRANS PROCSNG	506	1.1000
DISTRICT 7	[illegible]	#7 TO TRANS PROCSNG	507	14.9000
DISTRICT 8	[illegible]	#7 TO TRANS PROCSNG	507	217.2000
DISTRICT 9	[illegible]	#2 TRANS	502	36.9000
DISTRICT 10	[illegible]	#7 TO TRANS PROCSNG	507	75.2000
DISTRICT 11	[illegible]	#7 TO TRANS PROCSNG	507	12.7000
DISTRICT 12	[illegible]	#4 TO TRANS PROCSNG	504	3.3000
DISTRICT 13	[illegible]	#7 TO TRANS PROCSNG	507	131.9000
DISTRICT 14	[illegible]	#1 TRANS	501	144.4000
DISTRICT 15	[illegible]	#3 TRANS	503	14.3000
DISTRICT 16	[illegible]	#7 TO TRANS PROCSNG	507	15.7000
DISTRICT 17	[illegible]	#4 C7 TRANS	504	[illegible]
DISTRICT 18	[illegible]	[illegible] TRANS	[illegible]	[illegible][1]
DISTRICT 19	[illegible]	#9 C9 TRANS	[illegible]	1.1000[1]
[illegible]	[illegible]	#9 C9 TRANS	509	44.6000
[illegible]	[illegible]	#4 C7 TRANS	504	3.7000
[illegible]	[illegible]	#11 C1 TRANS	511	6.0000
[illegible]	[illegible]	#10 TO TRANS PROCSNG	510	[illegible]
[illegible]	[illegible]	#10 TO TRANS PROCSNG	510	95.5000
[illegible]	[illegible]	#4 TRANS PROCSNG	[illegible]	[illegible]
[illegible]	[illegible]	#5 TRANS PROCSNG	505	[illegible]
[illegible]	[illegible]	#5 TRANS PROCSNG	505	56.7200
[illegible]	[illegible]	#6 TO TRANS PROCSNG	506	158.4300
[illegible]	[illegible]	#1 T2 TRANS	501	[illegible]
[illegible]	[illegible]	#10 TO TRANS PROCSNG	510	57.0000
[illegible]	[illegible]	#6 TO TRANS PROCSNG	506	379.7993
[illegible]	[illegible]	#6 TO TRANS PROCSNG	506	173.4000

Reproduced from best available copy.

---

[1] District 118 mod; change 118 to 508 to zero; change 118 to 509 to 35.8.

St. Louis A

Table XXI

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME		ORIGIN PROCESS NAME		DESTINATION SITE NAME		ACTIVITY LEVEL*
M1 TRANS	501	TRANS PKR TO VAN	901	M10 T6 TRANS PROCSNG	510	37.9000
M2 TRANS	502	TRANS PKR TO VAN	901	M7 T5 TRANS PROCSNG	507	86.9000
M3 TRANS	503	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	155.2000
M4 TRANS	504	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	4.5000
M5 TRANS PROCSNG	505	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	0.0
M6 T4 TRANS PROCSNG	506	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	0.0
M6 T4 TRANS PROCSNG	506	SHREDDED FUEL PROCSS	905	M5 SECOND PROC	605	94.3070
M7 T5 TRANS PROCSNG	507	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	0.0
M7 T5 TRANS PROCSNG	507	SHREDDED FUEL PROCSS	905	M5 SECOND PROC	605	53.97[illegible]
M8 T2 TRANS	508	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	294.6370[1]
M9 C2 TRANS	509	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	51.5000[2]
M10 T6 TRANS PROCSNG	510	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	0.0
M10 T6 TRANS PROCSNG	510	SHREDDED FUEL PROCSS	905	M5 SECOND PROC	605	28.6650
M11 C1 TRANS	511	TRANS PKR TO VAN	901	M5 T4 TRANS PROCSNG	506	0.0

1. District 118 mod; change 508-901-505 to 258.837
2. District 118 mod; change 509-901-505 to 87.3

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE		ORIGIN PROCESS	DESTINATION SITE		LEVEL
M1 TRANS	501	903	U2 LABADIE MKT PROC	515	0.0
M3 TRANS	503	903	U2 LABADIE MKT PROC	515	0.0
M4 TRANS	504	903	U2 LABADIE MKT PROC	515	0.0
M5 TRANS PROCSNG	505	903	U2 LABADIE MKT PROC	515	0.0
M5 TRANS PROCSNG	505	905	M5 SECOND PROC	605	137.2748
M6 T4 TRANS PROCSNG	506	903	U2 LABADIE MKT PROC	515	0.0
M7 T5 TRANS PROCSNG	507	903	U2 LABADIE MKT PROC	515	0.0
M8 T2 TRANS	508	903	U2 LABADIE MKT PROC	515	0.0
M9 C2 TRANS	509	902	U2 LABADIE MKT PROC	515	0.0
M10 T6 TRANS PROCSNG	510	903	U2 LABADIE MKT PROC	515	0.0
M11 C1 TRANS	511	902	U2 LABADIF MKT PROC	515	0.0
T1 TRANS	512	903	U2 LABADIE MKT PROC	515	0.0
T3 TRANS	513	903	U2 LABADIE MKT PROC	515	0.0
U1 MERAMEC MKT PROC	514	905	U1 MERAMEC SECOND PR	614	0.0
U2 LABADIE MKT PROC	515	905	U2 LABADIE SECOND PR	615	0.0

Table XXI

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME		PROCESS NAME		ACTIVITY LEVEL *	LINEAR SEGMENT
01 TRANS	501	TRANS PKR TO VAN	901	37.9000	1
02 TRANS	502	TRANS PKR TO VAN	901	86.9000	2
03 TRANS	503	TRANS PKR TO VAN	901	165.2000	3
04 TRANS	504	TRANS PKR TO VAN	901	4.5000	1
05 TRANS PROCSNG	505	SHREDDED FUEL PROCSS.	905	1055.9597	3
06 T4 TRANS PROCSNG	506	SHREDDED FUEL PROCSS	905	725.4380	2
07 T5 TRANS PROCSNG	507	SHREDDED FUEL PROCSS	905	492.0994	2
08 T2 TRANS	508	TRANS PKR TO VAN	901	294.6370	3[1]
09 C2 TRANS	509	TRANS PKR TO VAN	901	51.5000	1[2]
010 T6 TRANS PROCSNG	510	SHREDDED FUEL PROCSS	905	220.5000	2
T1 TRANS	512	TRANS PKR VN TO RAIL	903	0.0	1
T3 TRANS	513	TRANS PKR VN TO RAIL	903	0.0	1
U1 MERAMEC MKT PROC	514	SHREDDED FUEL PROCSS	905	0.0	1
U2 LABADIE MKT PROC	515	SHREDDED FUEL PROCSS	905	0.0	1
05 SECOND PROC	605	SECONDARY RECOVERY	906	324.2197	2
06 SECOND PROC	606	SECONDARY RECOVERY	906	0.0	1
07 SECOND PROC	607	SECONDARY RECOVERY	906	0.0	1
010 SECOND PROC	610	SECONDARY RECOVERY	906	0.0	1
U1 MERAMEC SECOND PR	614	SECONDARY RECOVERY	906	0.0	1
U2 LABADIE SECOND PR	615	SECONDARY RECOVERY	906	0.0	1
05 WEST COUNTY	705	SANITARY LANDFILL	907	0.0	1
06 MAL	706	SANITARY LANDFILL	907	0.0	1

1. District 118 mod; change to 258.837
2. District 118 mod; change to 509-901-Segment 2 at 87.3

Table XXII

OUTPUTS FOR ST. LOUIS A-1
(Phase 4 Solution)

As Calculated:

OBJECTIVE VALUE IS	3501.9929 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS
TOTAL TONNAGE IS	2493.9970 IN THOUSANDS OF TONS PER YEAR
AVERAGE SYSTEM COST IS	1.4042 PER TON

	District 118 Mod:	
	Mod Increment	Adjusted Values
Objective Value	+97.87216	3599.86506
Average System Cost	+ .03924	1.44341

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN NAME	I D	DESTINATION NAME	I D	ACTIVITY LEVEL *
DISTRICT 1	101	M1 TRANS	501	5.9000
DISTRICT 2	102	M1 TRANS	501	32.0000
DISTRICT 3	103	M4 TRANS	504	4.5000
DISTRICT 4	104	M10 T6 TRANS PROCSNG	510	10.9000
DISTRICT 5	105	M6 T4 TRANS PROCSNG	506	53.3000
DISTRICT 6	106	M6 T4 TRANS PROCSNG	506	1.1000
DISTRICT 7	107	M7 T5 TRANS PROCSNG	507	14.9000
DISTRICT 8	108	M7 T5 TRANS PROCSNG	507	218.2000
DISTRICT 9	109	M2 TRANS	502	86.9000
DISTRICT 10	110	M7 T5 TRANS PROCSNG	507	38.2000
DISTRICT 11	111	M7 T5 TRANS PROCSNG	507	13.7000
DISTRICT 12	112	M7 T5 TRANS PROCSNG	507	9.9000
DISTRICT 13	113	M7 T5 TRANS PROCSNG	507	103.5000
DISTRICT 14	114	M3 TRANS	503	148.4000
DISTRICT 15	115	M3 TRANS	503	16.8000
DISTRICT 16	116	M7 T5 TRANS PROCSNG	507	16.7000
DISTRICT 17	117	M9 C2 TRANS	509	2.3000
DISTRICT 18	118	M8 T2 TRANS	508	35.8000[1]
DISTRICT 19	119	M9 C2 TRANS	509	1.1000
DISTRICT 20	120	M9 C2 TRANS	509	44.4000
DISTRICT 21	121	M9 C2 TRANS	509	3.7000
DISTRICT 22	122	M10 T6 TRANS PROCSNG	510	58.1000
DISTRICT 23	123	M10 T6 TRANS PROCSNG	510	46.6000
DISTRICT 24	124	M5 TRANS PROCSNG	505	147.0000
DISTRICT 25	125	M5 TRANS PROCSNG	505	330.8999
DISTRICT 26	125	M6 T4 TRANS PROCSNG	506	185.8444
DISTRICT 26	126	M8 T2 TRANS	508	328.1538
DISTRICT 27	127	M8 T2 TRANS	508	67.0000
DISTRICT 28	128	M6 T4 TRANS PROCSNG	506	339.7998
DISTRICT 29	129	M6 T4 TRANS PROCSNG	506	128.4000

1. District 118 mode; 118-508 changed to 0; 118-509 changed to 35.8.

Table XXII

Page 3 of 4

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
M1 TRANS	501	TRANS PKR TO VAN	901	M10 T6 TRANS PROCSNG	510	37.9000
M2 TRANS	502	TRANS PKR TO VAN	901	M7 T5 TRANS PROCSNG	507	86.9000
M3 TRANS	503	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	165.2000
M4 TRANS	504	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	4.5000
M5 TRANS PROCSNG	505	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	0.0
M6 T4 TRANS PROCSNG	506	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	0.0
M6 T4 TRANS PROCSNG	506	SHREDDED FUEL PROCSS	905	M5 SECOND PROC	605	97.7569
M7 T5 TRANS PROCSNG	507	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	0.0
M7 T5 TRANS PROCSNG	507	SHREDDED FUEL PROCSS	905	M5 SECOND PROC	605	65.2599
M8 T2 TRANS	508	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	430.9534[1]
M9 C2 TRANS	509	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	51.5000[2]
M10 T6 TRANS PROCSNG	510	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	114.4677
M10 T6 TRANS PROCSNG	510	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	39.0319
M11 T1 TRANS	511	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	0.0

1. District 110 mod; change to 395.1534
2. District 110 mod; change to 87.3

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
M5 TRANS PROCSNG	505	SHREDDED FUEL PROCSS	905	M5 SECOND PROC	605	161.2028

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
[illegible]	501	TRANS PER TO VAN	901	37.9000	1
[illegible]	502	TRANS PER TO VAN	901	86.9000	2
[illegible]	503	TRANS PER TO VAN	901	165.2000	3
[illegible]	504	TRANS PER TO VAN	901	4.5000	1
[illegible]	505	SHREDDED FUEL PROCESS	905	1240.0208	3
[illegible]	506	SHREDDED FUEL PROCESS	905	751.9749	2
[illegible]	507	SHREDDED FUEL PROCESS	905	901.9993	2
[illegible]	508	TRANS PER TO VAN	901	430.9534	3[1]
[illegible]	509	TRANS PER TO VAN	901	51.5000	1[2]
[illegible]	[illegible]	TRANS PER TO VAN	901	153.4996	3
[illegible]	[illegible]	SHREDDED FUEL PROCESS	905	0.0004	1
[illegible]	[illegible]	TRANS PER TO VAN	901	0.0	1
[illegible]	[illegible]	SECONDARY RECOVERY	906	324.2197	2
[illegible]	[illegible]	SECONDARY RECOVERY	906	0.0	1
[illegible]	[illegible]	SECONDARY RECOVERY	906	0.0	1
[illegible]	[illegible]	SECONDARY RECOVERY	906	0.0	1

1. District 110 mod; change to 395.1534
2. District 110 mod; change to 509-901-Segment 2 at 87.3

Table XXIII
OUTPUTS FOR ST. LOUIS B AND ST. LOUIS B-1
(Phase 3 Solutions)

TOTAL TONNAGE is 2493.9970 IN THOUSANDS OF TONS PER YEAR

	As Calculated	District 118 Mod Increment	As Adjusted
St. Louis B:			
Objective Value in Thousands of Dollars Per Year*	3017.7942	+97.87216	3115.66636
Average System Cost Per Ton	1.210023	+ .03924	1.249266
St. Louis B-1:			
Objective Value in Thousands of Dollars Per Ton*	3909.8574	+97.87216	4007.72956
Average System Cost Per Ton	1.5677	+ .03924	1.60695

*Including all haul costs from the loading of packer trucks on.

Table XXIII

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO ULTIMATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN NAME	I D	DESTINATION NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
[illegible]	[illegible]	[illegible]	[illegible]	12.1000	1

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN NAME	I D	DESTINATION NAME	I D	ACTIVITY LEVEL *
[illegible]	[illegible]	[illegible]	[illegible]	5.4000
[illegible]	[illegible]	[illegible]	[illegible]	32.0000
[illegible]	[illegible]	[illegible]	[illegible]	4.5000
[illegible]	[illegible]	[illegible]	[illegible]	10.9000
[illegible]	[illegible]	[illegible]	[illegible]	53.3000
[illegible]	[illegible]	[illegible]	[illegible]	1.1000
[illegible]	[illegible]	[illegible]	[illegible]	14.9000
[illegible]	[illegible]	[illegible]	[illegible]	218.2000
[illegible]	[illegible]	[illegible]	[illegible]	54.9000
[illegible]	[illegible]	[illegible]	[illegible]	38.2000
[illegible]	[illegible]	[illegible]	[illegible]	1.6000
[illegible]	[illegible]	[illegible]	[illegible]	9.9000
[illegible]	[illegible]	[illegible]	[illegible]	133.5000
[illegible]	[illegible]	[illegible]	[illegible]	148.4000
[illegible]	[illegible]	[illegible]	[illegible]	16.8000
[illegible]	[illegible]	[illegible]	[illegible]	16.7000
[illegible]	[illegible]	[illegible]	[illegible]	2.3500
[illegible]	[illegible]	[illegible]	[illegible]	35.8000[1]
[illegible]	[illegible]	[illegible]	[illegible]	1.2000
[illegible]	[illegible]	[illegible]	[illegible]	44.4000
[illegible]	[illegible]	[illegible]	[illegible]	3.7000
[illegible]	[illegible]	[illegible]	[illegible]	0.0
[illegible]	[illegible]	[illegible]	[illegible]	50.1000
[illegible]	[illegible]	[illegible]	[illegible]	46.6000
[illegible]	[illegible]	[illegible]	[illegible]	147.0000
[illegible]	[illegible]	[illegible]	[illegible]	330.9999
[illegible]	[illegible]	[illegible]	[illegible]	67.3727
[illegible]	[illegible]	[illegible]	[illegible]	187.4393
[illegible]	[illegible]	[illegible]	[illegible]	258.1916
[illegible]	[illegible]	[illegible]	[illegible]	67.0000
[illegible]	[illegible]	[illegible]	[illegible]	339.7998
[illegible]	[illegible]	[illegible]	[illegible]	129.4000

1. District 118 mod; change 118-508 to 0; change 118-509 to 35.8.

Reproduced from best available copy.

[illegible]

Table XXIII

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIRS
ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37.9060
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	86.9000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	141.1500
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.5000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	94.3071
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	62.3995
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	293.9812[1]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	51.5000[2]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	29.6650
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0

1. Effective [illegible] mod; change to 258.1812
2. Effective [illegible] mod; change to 37.3

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO ULTIMATE FACILITY PAIRS
ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
[illegible]	[illegible]	[illegible]	[illegible]	[illegible] FRANKLIN COUNTY	[illegible]	0.0

[illegible]

St. Louis B and B-1

Table XXIII

Page 5 of 5

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
M1 TRANS	501	TRANS PKR TO VAN	901	37.9000	1
M2 TRANS	502	TRANS PKR TO VAN	901	86.9000	2
M3 TRANS	503	TRANS PKR TO VAN	901	165.2000	3
M4 TRANS	504	TRANS PKR TO VAN	901	4.5000	1
M5 TRANS PROCSNG	505	SHREDDED FUEL PROCSS	905	1055.9597	3
M6 T4 TRANS PROCSNG	506	SHREDDED FUEL PROCSS	905	725.4385	2
M7 T5 TRANS PROCSNG	507	SHREDDED FUEL PROCSS	905	479.9995	2
M8 T2 TRANS	508	TRANS PKR TO VAN	901	293.9912[1]	3
M9 C2 TRANS	509	TRANS PKR TO VAN	901	51.5000[2]	1
M10 T6 TRANS PROCSNG	510	SHREDDED FUEL PROCSS	905	220.5000	2
T1 TRANS	512	TRANS PKR VN TO RAIL	903	0.0	1
T3 TRANS	513	TRANS PKR VN TO RAIL	903	0.0	1
U1 MERAMEC MKT PROC	514	SHREDDED FUEL PROCSS	905	0.0	1
M5 SECOND PROC	605	SECONDARY RECOVERY	906	322.6465	2
M7 SECOND PROC	607	SECONDARY RECOVERY	906	0.0	1
A1 SULLIVAN MUNICIPL	701	SANITARY LANDFILL	907	0.0	1
A2 FRANKLIN COUNTY	702	SANITARY LANDFILL	907	0.0	1
A5 WEST COUNTY	703	SANITARY LANDFILL	907	0.0	1
A6 JEFFERSON COUNTY	704	SANITARY LANDFILL	907	0.0	1
A8 ALTON MUNICIPAL	705	SANITARY LANDFILL	907	0.0	1
A9 MAL	706	SANITARY LANDFILL	907	0.0	1
A10 MODERN SANITATN	707	SANITARY LANDFILL	907	0.0	1
A14 BROWN MARISSA	708	SANITARY LANDFILL	907	12.1000	1
A16 BARTON-RUKANNA	709	SANITARY LANDFILL	907	0.0	1
A18 ANTONIA	710	SANITARY LANDFILL	907	0.0	1
A19 VIGUS QUARRY	711	SANITARY LANDFILL	907	0.0	1
A21 VALLEY DISPOSAL	712	SANITARY LANDFILL	907	0.0	1
A22 ALTON BRICK	713	SANITARY LANDFILL	907	0.0	1

1. District 118 mod; change to 258.1812.
2. District 118 mod; change to 509-901-Segment 2 at 87.3

Table XXIV

OUTPUTS FOR ST. LOUIS C
(Phase 3 Solution)

As Calculated:

OBJECTIVE VALUE IS 4463.9688 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS 2493.9978 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS 1.7899 PER TON

	District 118 Mod:	
	Mod Increment	Adjusted Values
Objective Value	+122.700874	4586.66967
Average System Cost	+ .049198	1.839083

Table XXIV

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN NAME	I D	DESTINATION NAME	I D	ACTIVITY LEVEL *
DISTRICT 1	101	M1 TRANS	501	5.9000
DISTRICT 2	102	M1 TRANS	501	32.0000
DISTRICT 3	103	M4 TRANS	504	4.5000
DISTRICT 4	104	M10 T6 TRANS PROCSNG	510	10.9000
DISTRICT 5	105	M6 T4 TRANS PROCSNG	506	53.3000
DISTRICT 6	106	M8 T2 TRANS	508	1.1000
DISTRICT 7	107	M7 PROCESSING	507	14.9000
DISTRICT 8	108	M7 PROCESSING	507	218.2000
DISTRICT 9	109	M2 TRANS	502	86.9000
DISTRICT 10	110	M7 PROCESSING	507	38.2000
DISTRICT 11	111	M7 PROCESSING	507	13.7000
DISTRICT 12	112	M7 PROCESSING	507	9.9000
DISTRICT 13	113	M7 PROCESSING	507	103.5000
DISTRICT 14	114	M3 TRANS	503	140.4000
DISTRICT 15	115	M3 TRANS	503	16.8000
DISTRICT 16	116	M7 PROCESSING	507	16.7000
DISTRICT 17	117	M9 C2 TRANS	509	2.3000
DISTRICT 18	118	M8 T2 TRANS	508	35.8000[1]
DISTRICT 19	119	M10 T6 TRANS PROCSNG	510	1.1000
DISTRICT 20	120	M9 C2 TRANS	509	44.4000
DISTRICT 21	121	M9 C2 TRANS	509	3.7000
DISTRICT 21	121	M11 C1 TRANS	511	0.0000
DISTRICT 22	122	M10 T6 TRANS PROCSNG	510	58.1000
DISTRICT 23	123	M10 T6 TRANS PROCSNG	510	46.6000
DISTRICT 24	124	M5 TRANS PROCSNG	505	147.0000
DISTRICT 25	125	M5 TRANS PROCSNG	505	330.8999
DISTRICT 26	126	M5 TRANS PROCSNG	505	101.6457
DISTRICT 26	126	M8 T2 TRANS	508	412.3542
DISTRICT 27	127	M10 T6 TRANS PROCSNG	510	67.0000
DISTRICT 28	128	M6 T4 TRANS PROCSNG	506	339.7998
DISTRICT 29	129	M8 T2 TRANS	508	128.4000

1. District 118 mod; change 118-508 to 0; change 118-509 to 35.8

St. Louis C

Table XXIV

Page 3 of 4

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
M1 TRANS	501	TRANS PKR TO VAN	901	M10 T6 TRANS PROCSNG	510	37.9000
M2 TRANS	502	TRANS PKR TO VAN	901	M7 PROCESSING	507	86.9000
M3 TRANS	503	TRANS PKR TO VAN	901	M7 PROCESSING	507	165.2066
M4 TRANS	504	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	4.5000
M5 TRANS PROCSNG	505	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	579.5454
M5 TRANS PROCSNG	505	SHREDDED FUEL PROCSS	909	M6 SECOND PROC	606	0.0
M6 T4 TRANS PROCSNG	506	TRANS PKR TO VAN	901	M10 T6 TRANS PROCSNG	510	0.0
M8 T2 TRANS	508	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	577.6538[1]
M9 C2 TRANS	509	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	10.8521[2]
M9 C2 TRANS	509	TRANS PKR TO VAN	901	M10 T6 TRANS PROCSNG	510	31.5478
M10 T6 TRANS PROCSNG	510	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	0.0
M10 T6 TRANS PROCSNG	510	SHREDDED FUEL PROCSS	935	M6 SECOND PROC	606	32.9092
M11 C1 TRANS	511	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	0.0

1. District 118 mod; change to 541.8538
2. District 118 mod; change to 54.6521

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
M5 TRANS PROCSNG	505	SHREDDED FUEL PROCSS	905	M5 SECOND PROC	605	0.0
M6 T4 TRANS PROCSNG	506	SHREDDED FUEL PROCSS	905	M6 SECOND PROC	606	204.5746
M7 PROCESSING	507	SHREDDED FUEL PROCSS	905	M7 SECOND PROC	607	86.7359
M10 T6 TRANS PROCSNG	510	SHREDDED FUEL PROCSS	905	M10 SECOND PROC	610	0.0

Table XXIV

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
M1 TRANS	501	TRANS PKR TO VAN	901	37.9000	1
M2 TRANS	502	TRANS PKR TO VAN	901	86.9000	2
M3 TRANS	503	TRANS PKR TO VAN	901	165.2000	3
M4 TRANS	504	TRANS PKR TO VAN	901	4.5000	1
M5 TRANS PROCSNG	505	TRANS PKR TO VAN	901	579.5456	3
M6 T4 TRANS PROCSNG	506	SHREDDED FUEL PROCSS	905	1573.6514	3
M7 PROCESSING	507	SHREDDED FUEL PROCSS	905	667.1995	2
M8 T2 TRANS	508	TRANS PKR TO VAN	901	577.6539[1]	3
M9 C2 TRANS	509	TRANS PKR TO VAN	901	50.3999[2]	1
M10 T6 TRANS PROCSNG	510	SHREDDED FUEL PROCSS	905	253.1474	2
M6 SECOND PROC	606	SECONDARY RECOVERY	906	237.4839	2
M7 SECOND PROC	607	SECONDARY RECOVERY	906	86.7359	1

1. District 118 mod; change to 541.8538
2. District 118 mod; change to 509-901-Segment 2 at 86.1999

Page 1 of 4

Table XXV

OUTPUTS FOR ST. LOUIS E
(Phase 4 Solution)

As Calculated:

OBJECTIVE VALUE IS	3606.7139 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS
TOTAL TONNAGE IS	2113.0981 IN THOUSANDS OF TONS PER YEAR
AVERAGE SYSTEM COST IS	1.7068 PER TON

	District 118 Mod:	
	Mod Increment	Adjusted Values
Objective Value	+96.39576	3703.10966
Average System Cost	+ .038651	1.752455

Table XXV

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN NAME	I D	DESTINATION NAME	I D	ACTIVITY LEVEL *
DISTRICT 1	101	M1 TRANS	501	5.1000
DISTRICT 2	102	M1 TRANS	501	29.9000
DISTRICT 3	103	M6 TRANS	506	4.3000
DISTRICT 4	104	M10 T6 TRANS PROCSNG	510	10.3000
DISTRICT 5	105	M6 T4 TRANS PROCSNG	506	48.5000
DISTRICT 6	106	M6 T4 TRANS PROCSNG	506	1.0000
DISTRICT 7	107	M7 T5 TRANS PROCSNG	507	14.1000
DISTRICT 8	108	M7 T5 TRANS PROCSNG	507	205.0000
DISTRICT 9	109	M2 TRANS	502	74.9000
DISTRICT 10	110	M7 T5 TRANS PROCSNG	507	23.3000
DISTRICT 11	111	M7 T5 TRANS PROCSNG	507	12.9000
DISTRICT 12	112	M7 T5 TRANS PROCSNG	507	8.7000
DISTRICT 13	113	M7 T5 TRANS PROCSNG	507	92.0000
DISTRICT 14	114	M3 TRANS	503	135.3000
DISTRICT 15	115	M3 TRANS	503	35.0000
DISTRICT 16	116	M7 T5 TRANS PROCSNG	507	14.5000
DISTRICT 17	117	M9 C2 TRANS	509	2.1000
DISTRICT 18	118	M8 T2 TRANS	508	33.8000[1]
DISTRICT 19	119	M9 C2 TRANS	509	1.0000
DISTRICT 20	120	M9 C2 TRANS	509	39.8000
DISTRICT 21	121	M9 C2 TRANS	509	3.5000
DISTRICT 22	122	M10 T6 TRANS PROCSNG	510	46.8000
DISTRICT 23	123	M10 T6 TRANS PROCSNG	510	38.4000
DISTRICT 24	124	M5 TRANS PROCSNG	505	122.5000
DISTRICT 25	125	M5 TRANS PROCSNG	505	282.0999
DISTRICT 26	126	M8 T2 TRANS	509	405.5000
DISTRICT 27	127	M8 T2 TRANS	509	52.2000
DISTRICT 28	128	M6 T4 TRANS PROCSNG	506	282.3999
DISTRICT 29	129	M8 T2 TRANS	508	109.2000

1. District 118 mod; change 118-508 to 0; change 118-509 to 33.8

St. Louis E

Table XXV

Page 3 of 4

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
M1 TRANS	501	TRANS PKR TO VAN	901	M10 T6 TRANS PROCSNG	510	34.0000
M2 TRANS	502	TRANS PKR TO VAN	901	M7 T5 TRANS PROCSNG	507	74.9000
M3 TRANS	503	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	111.2470
M3 TRANS	503	TRANS PKR TO VAN	901	M7 T5 TRANS PROCSNG	507	39.0530
M4 TRANS	504	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	4.3000
M5 TRANS PROCSNG	505	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	0.0
M6 T4 TRANS PROCSNG	506	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	336.1997
M6 T4 TRANS PROCSNG	506	SHREDDED FUEL PROCSS	905	M5 SECOND PROC	605	0.0006
M7 T5 TRANS PROCSNG	507	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	0.0
M7 T5 TRANS PROCSNG	507	SHREDDED FUEL PROCSS	905	M5 SECOND PROC	605	62.9788
M8 T2 TRANS	508	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	600.6995[1]
M9 C2 TRANS	509	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	46.4000[2]
M10 T6 TRANS PROCSNG	510	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	0.0
M10 T6 TRANS PROCSNG	510	SHREDDED FUEL PROCSS	905	M5 SECOND PROC	605	16.0350
M11 C1 TRANS	511	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	0.0

1. District 118 mod; change to 566.8995
2. District 118 mod; change to 80.2

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
M5 TRANS PROCSNG	505	SHREDDED FUEL PROCSS	905	M5 SECOND PROC	605	194.9889

St. Louis E

Table XXV

Page 4 of 4

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
M1 TRANS	501	TRANS PKR TO VAN	901	34.0000	1
M2 TRANS	502	TRANS PKR TO VAN	901	74.9000	2
M3 TRANS	503	TRANS PKR TO VAN	901	150.3000	3
M4 TRANS	504	TRANS PKR TO VAN	901	4.3000	1
M5 TRANS PROCSNG	505	SHREDDED FUEL PROCSS	905	1499.1460	3
M6 T4 TRANS PROCSNG	506	TRANS PKR TO VAN	901	336.1997	3
M7 T5 TRANS PROCSNG	507	SHREDDED FUEL PROCSS	905	484.4524	2
M8 T2 TRANS	508	TRANS PKR TO VAN	901	600.6995	3[1]
M9 C2 TRANS	509	TRANS PKR TO VAN	901	46.4000	1[2]
M10 T6 TRANS PROCSNG	510	SHREDDED FUEL PROCSS	905	129.5000	1
M11 C1 TRANS	511	TRANS PKR TO VAN	901	0.0	1
M5 SECOND PROC	605	SECONDARY RECOVERY	906	274.7026	2
M6 SECOND PROC	606	SECONDARY RECOVERY	906	0.0	1
M7 SECOND PROC	607	SECONDARY RECOVERY	906	0.0	1
M10 SECOND PROC	610	SECONDARY RECOVERY	906	0.0	1

1. District 118 mod; change to 566.8995
2. District 118 mod; change to 509-901-Segment 2 at 80.2

Page 1 of 4

Table XXVI

OUTPUTS FOR ST. LOUIS F
(Phase 3 Solution)

As Calculated:

OBJECTIVE VALUE IS	4728.8672 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS
TOTAL TONNAGE IS	2493.9978 IN THOUSANDS OF TONS PER YEAR
AVERAGE SYSTEM COST IS	1.8961 PER TON

	District 118 Mod:	
	Mod Increment	Adjusted Values
Objective Value	+137.07772	4865.94492
Average System Cost	+ .054963	1.951062

Table XXVI

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN NAME	I D	DESTINATION NAME	I D	ACTIVITY LEVEL *
DISTRICT 1	101	M1 TRANS	501	5.9000
DISTRICT 2	102	M1 TRANS	501	32.0000
DISTRICT 3	103	U2 LABADIE MKT PROC	515	4.5000
DISTRICT 4	104	M10 T6 TRANS PROCSNG	510	10.9000
DISTRICT 5	105	M6 T4 TRANS PROCSNG	506	53.3000
DISTRICT 6	106	M6 T4 TRANS PROCSNG	506	1.1000
DISTRICT 7	107	M7 T5 TRANS PROCSNG	507	14.9000
DISTRICT 8	108	M7 T5 TRANS PROCSNG	507	218.2000
DISTRICT 9	109	M2 TRANS	502	96.9000
DISTRICT 10	110	M7 T5 TRANS PROCSNG	507	38.2000
DISTRICT 11	111	M7 T5 TRANS PROCSNG	507	13.7000
DISTRICT 12	112	M6 T4 TRANS PROCSNG	506	9.9000
DISTRICT 13	113	M5 TRANS PROCSNG	505	103.5000
DISTRICT 14	114	M3 TRANS	503	148.4000
DISTRICT 15	115	M3 TRANS	503	16.8000
DISTRICT 16	116	M7 T5 TRANS PROCSNG	507	16.7000
DISTRICT 17	117	U2 LABADIE MKT PROC	515	2.3000
DISTRICT 18	118	M8 T2 TRANS	508	35.8000[1]
DISTRICT 19	119	U2 LABADIE MKT PROC	515	1.1000
DISTRICT 20	120	T1 TRANS	512	44.4000
DISTRICT 21	121	T1 TRANS	512	3.7000
DISTRICT 22	122	U2 LABADIE MKT PROC	515	58.1000
DISTRICT 23	123	M10 T6 TRANS PROCSNG	510	46.6000
DISTRICT 24	124	T1 TRANS	512	147.0000
DISTRICT 25	125	M5 TRANS PROCSNG	505	330.8999
DISTRICT 26	126	M8 T2 TRANS	508	514.0000
DISTRICT 27	127	T1 TRANS	512	67.0000
DISTRICT 28	128	M6 T4 TRANS PROCSNG	506	339.7998
DISTRICT 29	129	M8 T2 TRANS	508	128.4000

1. District 118 mod; change 118-508 to 0; change 118-509 to 35.8

St. Louis F

Table XXVI

Page 3 of 4

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
M1 TRANS	501	TRANS PKR TO VAN	901	U2 LABADIE MKT PROC	515	37.9000
M2 TRANS	502	TRANS PKR TO VAN	901	M7 T5 TRANS PROCSNG	507	86.9000
M3 TRANS	503	TRANS PKR TO VAN	901	M5 TRANS PROCSNG	505	0.0
M3 TRANS	503	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	0.0
M4 TRANS	504	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	0.0
M5 TRANS PROCSNG	505	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	0.0
M6 T4 TRANS PROCSNG	506	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	0.0
M7 T5 TRANS PROCSNG	507	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	0.0
M8 T2 TRANS	508	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	0.0
M9 C2 TRANS	509	TRANS PKR TO VAN	901	U2 LABADIE MKT PROC	515	0.0[1]
M10 T6 TRANS PROCSNG	510	TRANS PKR TO VAN	901	U2 LABADIE MKT PROC	515	57.5000
M11 C1 TRANS	511	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	0.0

1. District 118 mod; change to 35.8

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE.	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
M1 TRANS	501	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	0.0
M3 TRANS	503	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	165.2000
M4 TRANS	504	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	0.0
M5 TRANS PROCSNG	505	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	434.3999
M6 T4 TRANS PROCSNG	506	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	404.0996
M7 T5 TRANS PROCSNG	507	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	388.5996
M8 T2 TRANS	508	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	678.1997[2]
M9 C2 TRANS	509	TRANS PKR TO CNTNR	902	U2 LABADIE MKT PROC	515	0.0
M10 T6 TRANS PROCSNG	510	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	0.0
M11 C1 TRANS	511	TRANS PKR TO CNTNR	902	U2 LABADIE MKT PROC	515	0.0
T1 TRANS	512	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	262.0999
T3 TRANS	513	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	0.0
U1 MERAMEC MKT PROC	514	SHREDDED FUEL PROCSS	905	U1 MERAMEC SECOND PR	614	0.0
U2 LABADIE MKT PROC	515	SHREDDED FUEL PROCSS	905	U2 LABADIE SECOND PR	615	324.2190

2. District 118 mod; change to 642.3997

St. Louis F Table XXVI Page 4 of 4

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
M1 TRANS	501	TRANS PKR TO VAN	901	37.9000	1
M2 TRANS	502	TRANS PKR TO VAN	901	86.9000	2
M3 TRANS	503	TRANS PKR VN TO RAIL	903	165.2000	3
M4 TRANS	504	TRANS PKR TO VAN	901	0.0	1
M5 TRANS PROCSNG	505	TRANS PKR VN TO RAIL	903	434.3999	3
M6 T4 TRANS PROCSNG	506	TRANS PKR VN TO RAIL	903	404.0996	3
M7 T5 TRANS PROCSNG	507	TRANS PKR VN TO RAIL	903	348.5996	3
M8 T2 TRANS	508	TRANS PKR VN TO RAIL	903	678.1997	3 [1]
M9 C2 TRANS	509	TRANS PKR TO CNTNR	902	0.0	1 [2]
M10 T5 TRANS PROCSNG	510	TRANS PKR TO VAN	901	57.5000	2
M11 C1 TRANS	511	TRANS PKR TO CNTNR	902	0.0	1
T1 TRANS	512	TRANS PKR VN TO RAIL	903	262.0999	3
T3 TRANS	513	TRANS PKR VN TO RAIL	903	0.0	1
U1 MERAMEC MKT PROC	514	SHREDDED FUEL PROCSS	905	0.0	1
U2 LABADIE MKT PROC	515	SHREDDED FUEL PROCSS	905	2493.9985	3
M6 SECOND PROC	606	SECONDARY RECOVERY	906	0.0	1
M10 SECOND PROC	610	SECONDARY RECOVERY	906	0.0	1
U2 LABADIE SECOND PR	615	SECONDARY RECOVERY	906	324.2190	2

1. District 118 mod; change to 642.3997
2. District 118 mod; change to 35.8

TABLE XXVII
OUTPUTS FOR ST. LOUIS F-1 (Phase 4 Solution)

Page 1 of 3

```
OBJECTIVE VALUE IS    3995.0461 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS    2493.9978 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS      1.5058 PER TON


             TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
                            *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

                                                                             ACTIVITY
    ORIGIN NAME         I D      DESTINATION NAME      I D                    LEVEL *

   DISTRICT  1          101     M1 TRANS               501                    5.9000
   DISTRICT  2          102     M1 TRANS               501                   32.0000
   DISTRICT  3          103     U2 LABADIE MKT PROC    515                    4.5000
   DISTRICT  4          104     M10 T6 TRANS PROCSNG   510                   10.9000
   DISTRICT  5          105     U1 MERAMEC MKT PROC    514                   53.3000
   DISTRICT  6          106     U1 MERAMEC MKT PROC    514                    1.1000
   DISTRICT  7          107     U1 MERAMEC MKT PROC    514                   14.9000
   DISTRICT  8          108     M7 T5 TRANS PROCSNG    507                  218.2000
   DISTRICT  9          109     M2 TRANS               502                   86.9000
   DISTRICT 10          110     M7 T5 TRANS PROCSNG    507                   38.2000
   DISTRICT 11          111     M7 T5 TRANS PROCSNG    507                   13.7000
   DISTRICT 12          112     46 T4 TRANS PROCSNG    506                    9.9000
   DISTRICT 13          113     M5 TRANS PROCSNG       505                  103.5000
   DISTRICT 14          114     M3 TRANS               503                  148.4000
   DISTRICT 15          115     M3 TRANS               503                   16.8000
   DISTRICT 15          116     M7 T5 TRANS PROCSNG    507                   16.7000
   DISTRICT 17          117     U2 LABADIE MKT PRUC    515                    2.3000
   DISTRICT 18          118     M9 C2 TRANS            509                   35.8000
   DISTRICT 19          119     M9 C2 TRANS            509                    1.1000
   DISTRICT 20          120     T1 TRANS               512                   44.4000
   DISTRICT 21          121     T1 TRANS               512                    3.7000
   DISTRICT 22          122     U2 LABADIE MKT PRUC    515                   58.1000
   DISTRICT 23          123     M10 T6 TRANS PRUCSNG   510                   46.6000
   DISTRICT 24          124     T1 TRANS               512                  147.0000
   DISTRICT 25          125     M5 TRANS PROCSNG       505                  330.8999
   DISTRICT 26          126     M8 T2 TRANS            508                  514.0000
   DISTRICT 27          127     T1 TRANS               512                   67.0000
   DISTRICT 28          128     M6 T4 TRANS PROCSNG    506                  339.7998
   DISTRICT 29          129     M8 T2 TRANS            508                  128.4000
```

Table XXVII

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TUNS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
M1 TRANS	501	TRANS PKR TO VAN	901	U2 LABADIE MKT PROC	515	37.9000
M2 TRANS	502	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	86.9000
M3 TRANS	503	TRANS PKR TO VAN	901	M7 T5 TRANS PROCSNG	507	0.0
M4 TRANS	504	TRANS PKR TO VAN	901	M6 T4 TRANS PROCSNG	506	0.0
M5 TRANS PROCSNG	505	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	434.3999
M6 T4 TRANS PROCSNG	506	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	349.6997
M7 T5 TRANS PROCSNG	507	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	286.7988
M8 T2 TRANS	508	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	39.9006
M8 T2 TRANS	508	TRANS PKR TO VAN	901	U2 LABADIE MKT PROC	515	602.4990
M9 C2 TRANS	509	TRANS PKR TO VAN	901	U2 LABADIE MKT PROC	515	36.9000
M10 T6 TRANS PROCSNG	510	TRANS PKR TO VAN	901	U2 LABADIE MKT PROC	515	57.5000
M11 C1 TRANS	511	TRANS PKR TO VAN	901	U1 MERAMEC MKT PROC	514	0.0
U2 LABADIF MKT PROC	515	SHREDDED FUEL PROCSS	905	M10 SECUND PROC	610	0.0001

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THJUSANDS OF TUNS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
M3 TRANS	503	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	165.2000
M4 TRANS	504	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	0.0
M5 TRANS PROCSNG	505	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	0.0
M6 T4 TRANS PROCSNG	506	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	0.0
M7 T5 TRANS PROCSNG	507	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	0.0
M8 T2 TRANS	508	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	0.0
M9 C2 TRANS	509	TRANS PKR TO CNTNR	902	U2 LABADIE MKT PROC	515	0.0
M10 T6 TRANS PROCSNG	510	TRANS PKR VN TU RAIL	903	U2 LABADIE MKT PROC	515	0.0
M11 C1 TRANS	511	TRANS PKR TO CNTNR	902	U2 LABADIE MKT PROC	515	0.0
T1 TRANS	512	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	0.0
T3 TRANS	513	TRANS PKR VN TO RAIL	903	U2 LABADIE MKT PROC	515	262.0999
U1 MERAMEC MKT PROC	514	SHREDDED FUEL PROCSS	905	U2 LABADIE MKT PROC	515	0.0
U2 LABADIE MKT PROC	515	SHREDDED FUEL PRUCSS	905	U1 MERAMEC SECOND PR	614	164.7100
				U2 LABADIE SECOND PR	615	159.5093

Table XXVII

PROCESSING ACTIVITY LEVELS

*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
M1 TRANS	501	TRANS PKR TO VAN	901	37.9000	1
M2 TRANS	502	TRANS PKR TO VAN	901	86.9000	2
M3 TRANS	503	TRANS PKR VN TO RAIL	903	165.2000	3
M4 TRANS	504	TRANS PKR TO VAN	901	0.0	1
M5 TRANS PROCSNG	505	TRANS PKR TO VAN	901	434.3999	3
M6 T4 TRANS PROCSNG	506	TRANS PKR TO VAN	901	349.6997	3
M7 T5 TRANS PROCSNG	507	TRANS PKR TO VAN	901	286.7988	3
M8 T2 TRANS	508	TRANS PKR TO VAN	901	642.3999	3
M9 C2 TRANS	509	TRANS PKR TO VAN	901	36.9000	1
M10 T6 TRANS PROCSNG	510	TRANS PKR TO VAN	901	57.5000	2
M11 C1 TRANS	511	TRANS PKR TO VAN	901	0.0	1
T1 TRANS	512	TRANS PKR VN TO RAIL	903	262.0999	3
T3 TRANS	513	TRANS PKR VN TO RAIL	903	0.0	1
U1 MERAMEC MKT PROC	514	SHREDDED FUEL PROCSS	905	1266.9993	3
U2 LABADIE MKT PROC	515	SHREDDED FUEL PROCSS	905	1226.9983	3
U1 MERAMEC SECOND PR	614	SECONDARY RECOVERY	906	164.7100	2
U2 LABADIE SECOND PR	615	SECONDARY RECOVERY	906	159.5093	2

Table XXVIII
OUTPUTS FOR ST. LOUIS G (Dynamic)
(Phase 3 Solution)

Tonnage Summary

Period	No. of Years	Tons Per Year (thousands)	Ton-Years
1	3	2466.3992	7399.1976
2	10	3052.4976	30524.9760
3	7	4273.1939	29912.3573
4	5	5360.2904	26801.4520
Total	25	--	94637.9829

Discounted Average Cost Per Ton = -1.890778

St. Louis G

Table XXVIII

Page 2 of 13

DYNAMIC MODEL OUTPUT
MODEL PERIOD MAJOR SORT

OBJECTIVE VALUE IS -178939.3750 IN THOUSANDS OF DOLLARS DISCOUNTED TO YEAR ONE INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

```
                              ACTIVITY DATA FOR MODEL PERIOD 1

         TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO ULTIMATE FACILITY PAIR(S)
                      *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

   ORIGIN NAME        I D     DESTINATION NAME     I D          ACTIVITY    MODEL
                                                                 LEVEL *    PERIOD
 MADISON COUNTY       103     A19 VIGUS QUARRY     711
                                                                   0.0        1

                              ACTIVITY DATA FOR MODEL PERIOD 1

         TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
                      *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

   ORIGIN NAME        I D     DESTINATION NAME     I D          ACTIVITY    MODEL
                                                                 LEVEL *    PERIOD
 FRANKLIN COUNTY      101     M1 TRANS             501
 JEFFERSON COUNTY     102     M6 PROCESSING        506          39.1000       1
 JEFFERSON COUNTY     102     M10 TRANS/PYROLYSIS  510          65.5000       1
 JEFFERSON COUNTY     102     U1 MKT/PROCESSING    514           0.0          1
 MADISON COUNTY       103     M6 PROCESSING        506           0.0          1
 MADISON COUNTY       103     M7 TRANS/PYROLYSIS   507         280.0999       1
 MONROE COUNTY        104     M6 PROCESSING        506           0.0          1
 ST. CHARLES COUNTY   105     M6 PROCESSING        506          10.2000       1
 ST. CLAIR COUNTY     106     M6 PROCESSING        506          79.3000       1
 ST. LOUIS CITY       107     M6 PROCESSING        506         358.2000       1
 ST. LOUIS COUNTY     108     M6 PROCESSING        506         795.2996       1
                                                               838.7000       1
                        ACTIVITY DATA FOR MODEL PERIOD 1

      TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
                      *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME      I D    ORIGIN PROCESS NAME  I D    DESTINATION SITE NAME I D
                                                                                     ACTIVITY     MODEL
                                                                                      LEVEL *     PERIOD
M1 TRANS              501    TRANSFER PKR TO VAN  901    M6 PROCESSING          506
M7 TRANS/PYROLYSIS    507    TRANSFER PKR TO VAN  901    M6 PROCESSING          506   39.1000       1
M9 TRANS              509    TRANSFER PKR TO VAN  901    M6 PROCESSING          506    0.0          1
M10 TRANS/PYROLYSIS   510    TRANSFER PKR TO VAN  901    M6 PROCESSING          506    0.0          1
                                                                                       0.0          1
```

St. Louis G

Table XXVIII

Page 3 of 13

ACTIVITY DATA FOR MODEL PERIOD 1

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
M1 TRANS	501	TRANSPER PKR TO VAN	901	39.1000	1
M6 PROCESSING	506	SHREDDED FUEL/SEC RC	955	2466.3992	1
M7 TRANS/PYROLYSIS	507	TRANSFER PKR TO VAN	901	0.0	1
M9 TRANS	509	TRANSFER PKR TO VAN	901	0.0	1
M10 TRANS/PYROLYSIS	510	TRANSFER PKR TO VAN	901	0.0	1
U1 MKT/PROCESSING	514	SHREDDED FUEL/SEC RC	955	0.0	1
A19 VIGUS QUARRY	711	SANITARY LANDFILL	907	0.0	1

ACTIVITY DATA FOR MODEL PERIOD 1

CAPACITY BUILDING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	MODEL PERIOD	ACTIVITY LEVEL *	LINEAR SEGMENT
M1 TRANS	501	TRANSFER PKR TO VAN	901	1	75.9000	2
M6 PROCESSING	506	SHREDDED FUEL/SEC RC	955	1	2466.3992	3
M7 TRANS/PYROLYSIS	507	TRANSFER PKR TO VAN	901	1	0.0	1
M9 TRANS	509	TRANSFER PKR TO VAN	901	1	0.0	1
M10 TRANS/PYROLYSIS	510	TRANSFER PKR TO VAN	901	1	0.0	1
U1 MKT/PROCESSING	514	SHREDDED FUEL/SEC RC	955	1	0.0	1
A19 VIGUS QUARRY	711	SANITARY LANDFILL	907	1	0.0	1

ACTIVITY DATA FOR MODEL PERIOD 1

CAPACITY UNDERUTILIZATION ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	MODEL PERIOD	ACTIVITY LEVEL *
M1 TRANS	501	TRANSFER PKR TO VAN	901	1	36.8000

Table XXVIII

ACTIVITY DATA FOR MODEL PERIOD 2

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN NAME	I D	DESTINATION NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
FRANKLIN COUNTY	101	M1 TRANS	501	50.8000	2
JEFFERSON COUNTY	102	M6 PROCESSING	506	90.6000	2
JEFFERSON COUNTY	102	M10 TRANS/PYROLYSIS	510	0.0	2
JEFFERSON COUNTY	102	U1 MKT/PROCESSING	514	0.0	2
MADISON COUNTY	103	M7 TRANS/PYROLYSIS	507	361.6995	2
MONROE COUNTY	104	M7 TRANS/PYROLYSIS	507	14.8000	2
ST. CHARLES COUNTY	105	M9 TRANS	509	114.6000	2
ST. CLAIR COUNTY	106	M7 TRANS/PYROLYSIS	507	449.0999	2
ST. LOUIS CITY	107	M6 PROCESSING	506	895.5999	2
ST. LOUIS COUNTY	108	M6 PROCESSING	506	1075.2996	2

ACTIVITY DATA FOR MODEL PERIOD 2

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
M1 TRANS	501	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	50.8000	2
M7 TRANS/PYROLYSIS	507	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	2
M9 TRANS	509	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	114.6000	2
M10 TRANS/PYROLYSIS	510	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	2

ACTIVITY DATA FOR MODEL PERIOD 2

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
M1 TRANS	501	TRANSFER PKR TO VAN	901	50.8000	2
M6 PROCESSING	506	GAS PYROLYSIS	935	2226.8987	2
M7 TRANS/PYROLYSIS	507	TRANSFER PKR TO VAN	901	0.0	2
M7 TRANS/PYROLYSIS	507	GAS PYROLYSIS	935	825.5989	2
M9 TRANS	509	TRANSFER PKR TO VAN	901	114.6000	2
M10 TRANS/PYROLYSIS	510	TRANSFER PKR TO VAN	901	0.0	2
M10 TRANS/PYROLYSIS	510	GAS PYROLYSIS	935	0.0	2
U1 MKT/PROCESSING	514	SHREDDED FUEL/SEC RC	955	0.0	2
A19 VIGUS QUARRY	711	SANITARY LANDFILL	907	0.0	2

Table XXVIII

ACTIVITY DATA FOR MODEL PERIOD 2

CAPACITY BUILDING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	MODEL PERIOD	ACTIVITY LEVEL *	LINEAR SEGMENT
M6 PROCESSING	506	GAS PYROLYSIS	935	2	2226.8987	1
M7 TRANS/PYROLYSIS	507	GAS PYROLYSIS	935	2	825.5989	1
M9 TRANS	509	TRANSFER PKR TO VAN	901	2	271.0000	3
M10 TRANS/PYROLYSIS	510	GAS PYROLYSIS	935	2	0.0	1

ACTIVITY DATA FOR MODEL PERIOD 2

CAPACITY UNDERUTILIZATION ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	MODEL PERIOD	ACTIVITY LEVEL *
M1 TRANS	501	TRANSFER PKR TO VAN	901	2	25.1000
M6 PROCESSING	506	SHREDDED FUEL/SEC RC	955	2	2466.3992
M9 TRANS	509	TRANSFER PKR TO VAN	901	2	156.4000

ACTIVITY DATA FOR MODEL PERIOD 3

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO ULTIMATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN NAME	I D	DESTINATION NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
MADISON COUNTY	103	A19 VIGUS QUARRY	711	0.0	3

ACTIVITY DATA FOR MODEL PERIOD 3

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN NAME	I D	DESTINATION NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
FRANKLIN COUNTY	101	M1 TRANS	501	75.9000	3
JEFFERSON COUNTY	102	M6 PROCESSING	506	148.5000	3
MADISON COUNTY	103	M6 PROCESSING	506	350.2996	3
MADISON COUNTY	103	M7 TRANS/PYROLYSIS	507	189.4999	3
MONROE COUNTY	104	M6 PROCESSING	506	25.1000	3
ST. CHARLES COUNTY	105	M9 TRANS	509	195.3000	3
ST. CLAIR COUNTY	106	M7 TRANS/PYROLYSIS	507	636.0994	3
ST. LOUIS CITY	107	M6 PROCESSING	506	1070.2996	3
ST. LOUIS COUNTY	108	M6 PROCESSING	506	1582.2000	3

Table XXVIII

ACTIVITY DATA FOR MODEL PERIOD 3

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
M1 TRANS	501	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	75.9000	3
M7 TRANS/PYROLYSIS	507	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	3
M9 TRANS	509	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	195.3000	3
M10 TRANS/PYROLYSIS	510	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	3

ACTIVITY DATA FOR MODEL PERIOD 3

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
M1 TRANS	501	TRANSFER PKR TO VAN	901	75.9000	3
M6 PROCESSING	506	GAS PYROLYSIS	935	3447.5950	3
M7 TRANS/PYROLYSIS	507	GAS PYROLYSIS	935	825.5989	3
M9 TRANS	509	TRANSFER PKR TO VAN	901	195.3000	3
M10 TRANS/PYROLYSIS	510	GAS PYROLYSIS	935	0.0	3
U1 MKT/PROCESSING	514	SHREDDED FUEL/SEC RC	955	0.0	3
A19 VIGUS QUARRY	711	SANITARY LANDFILL	907	0.0	3

ACTIVITY DATA FOR MODEL PERIOD 3

CAPACITY BUILDING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	MODEL PERIOD	ACTIVITY LEVEL *	LINEAR SEGMENT
M6 PROCESSING	506	GAS PYROLYSIS	935	3	1220.6963	1
A19 VIGUS QUARRY	711	SANITARY LANDFILL	907	3	0.0	1

ACTIVITY DATA FOR MODEL PERIOD 3

CAPACITY UNDERUTILIZATION ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	MODEL PERIOD	ACTIVITY LEVEL *
M6 PROCESSING	506	SHREDDED FUEL/SEC RC	955	3	2466.3992
M9 TRANS	509	TRANSFER PKR TO VAN	901	3	75.7000

Table XXVIII

ACTIVITY DATA FOR MODEL PERIOD 4

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN NAME	I D	DESTINATION NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
FRANKLIN COUNTY	101	M1 TRANS	501	98.8000	4
JEFFERSON COUNTY	102	M6 PROCESSING	506	202.4000	4
MADISON COUNTY	103	M7 TRANS/PYROLYSIS	507	702.2996	4
MONROE COUNTY	104	M6 PROCESSING	506	34.8000	4
ST. CHARLES COUNTY	105	M9 TRANS	509	271.0000	4
ST. CLAIR COUNTY	106	M7 TRANS/PYROLYSIS	507	803.3997	4
ST. LOUIS CITY	107	M6 PROCESSING	506	1205.3997	4
ST. LOUIS COUNTY	108	M6 PROCESSING	506	2005.0020	4
ST. LOUIS COUNTY	108	M10 TRANS/PYROLYSIS	510	37.1976	4

ACTIVITY DATA FOR MODEL PERIOD 4

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
M1 TRANS	501	TRANSFER PKR TO VAN	901	M10 TRANS/PYROLYSIS	510	98.8000	4
M7 TRANS/PYROLYSIS	507	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	4
M9 TRANS	509	TRANSFER PKR TO VAN	901	M10 TRANS/PYROLYSIS	510	271.0000	4
M10 TRANS/PYROLYSIS	510	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	4

ACTIVITY DATA FOR MODEL PERIOD 4

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
M1 TRANS	501	TRANSFER PKR TO VAN	901	98.8000	4
M6 PROCESSING	506	GAS PYROLYSIS	935	3447.5874	4
M7 TRANS/PYROLYSIS	507	GAS PYROLYSIS	935	1505.6995	4
M9 TRANS	509	TRANSFER PKR TO VAN	901	271.0000	4
M10 TRANS/PYROLYSIS	510	GAS PYROLYSIS	935	406.9971	4
U1 MKT/PROCESSING	514	SHREDDED FUEL/SEC RC	955	0.0	4
A19 VIGUS QUARRY	711	SANITARY LANDFILL	907	0.0	4

Table XXVIII

```
                         ACTIVITY DATA FOR MODEL PERIOD 4

                        CAPACITY BUILDING ACTIVITY LEVELS
                  *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

     SITE NAME          I D        PROCESS NAME       I D   MODEL           ACTIVITY  LINEAR
                                                            PERIOD           LEVEL *  SEGMENT
M1 TRANS                501    TRANSFER PKR TO VAN    901     4
M6 PROCESSING           506    SHREDDED FUEL/SEC RC   955     4              98.8000     2
M7 TRANS/PYROLYSIS      507    TRANSFER PKR TO VAN    901     4               0.0        1
M7 TRANS/PYROLYSIS      507    GAS PYROLYSIS          935     4               0.0        1
M10 TRANS/PYROLYSIS     510    TRANSFER PKR TO VAN    901     4             680.0994     1
M10 TRANS/PYROLYSIS     510    GAS PYROLYSIS          935     4               0.0        1
U1 MKT/PROCESSING       514    SHREDDED FUEL/SEC RC   955     4             406.9971     1
                                                                              0.0        1


              LAND CONSTRAINT ACTIVITY LEVELS OF SLACKS IN ACRE-FEET

                        SITE       ACTIVITY LEVEL
                         711          20000.0000
```

St. Louis G

Table XXVIII

Page 9 of 13

DYNAMIC MODEL OUTPUT
MODEL PERIOD INNER SORT

OBJECTIVE VALUE IS -178939.3750 IN THOUSANDS OF DOLLARS DISCOUNTED TO YEAR ONE INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

```
             TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO ULTIMATE FACILITY PAIR(S)
                        *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

   ORIGIN NAME        I D      DESTINATION NAME      I D          ACTIVITY    MODEL
                                                                   LEVEL *    PERIOD
MADISON COUNTY        103     A19 VIGUS QUARRY       711            0.0         1
MADISON COUNTY        103     A19 VIGUS QUARRY       711            0.0         3
```

Table XXVIII

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN NAME	I D	DESTINATION NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
FRANKLIN COUNTY	101	M1 TRANS	501	39.1000	1
FRANKLIN COUNTY	101	M1 TRANS	501	50.8000	2
FRANKLIN COUNTY	101	M1 TRANS	501	75.9000	3
FRANKLIN COUNTY	101	M1 TRANS	501	98.8000	4
JEFFERSON COUNTY	102	M6 PROCESSING	506	65.5000	1
JEFFERSON COUNTY	102	M6 PROCESSING	506	90.6000	2
JEFFERSON COUNTY	102	M6 PROCESSING	506	148.5000	3
JEFFERSON COUNTY	102	M6 PROCESSING	506	202.4000	4
JEFFERSON COUNTY	102	M10 TRANS/PYROLYSIS	510	0.0	1
JEFFERSON COUNTY	102	M10 TRANS/PYROLYSIS	510	0.0	2
JEFFERSON COUNTY	102	U1 MKT/PROCESSING	514	0.0	1
JEFFERSON COUNTY	102	U1 MKT/PROCESSING	514	0.0	2
MADISON COUNTY	103	M6 PROCESSING	506	280.0999	1
MADISON COUNTY	103	M6 PROCESSING	506	350.2996	3
MADISON COUNTY	103	M7 TRANS/PYROLYSIS	507	0.0	1
MADISON COUNTY	103	M7 TRANS/PYROLYSIS	507	361.6995	2
MADISON COUNTY	103	M7 TRANS/PYROLYSIS	507	189.4999	3
MADISON COUNTY	103	M7 TRANS/PYROLYSIS	507	702.2996	4
MONROE COUNTY	104	M6 PROCESSING	506	10.2000	1
MONROE COUNTY	104	M6 PROCESSING	506	25.1000	3
MONROE COUNTY	104	M6 PROCESSING	506	34.8000	4
MONROE COUNTY	104	M7 TRANS/PYROLYSIS	507	14.8000	2
ST. CHARLES COUNTY	105	M6 PROCESSING	506	79.3000	1
ST. CHARLES COUNTY	105	M9 TRANS	509	114.6000	2
ST. CHARLES COUNTY	105	M9 TRANS	509	195.3000	3
ST. CHARLES COUNTY	105	M9 TRANS	509	271.0000	4
ST. CLAIR COUNTY	106	M6 PROCESSING	506	358.2000	1
ST. CLAIR COUNTY	106	M7 TRANS/PYROLYSIS	507	449.0999	2
ST. CLAIR COUNTY	106	M7 TRANS/PYROLYSIS	507	636.0994	3
ST. CLAIR COUNTY	106	M7 TRANS/PYROLYSIS	507	803.3997	4
ST. LOUIS CITY	107	M6 PROCESSING	506	795.2996	1
ST. LOUIS CITY	107	M6 PROCESSING	506	895.5999	2
ST. LOUIS CITY	107	M6 PROCESSING	506	1070.2996	3
ST. LOUIS CITY	107	M6 PROCESSING	506	1205.3997	4
ST. LOUIS COUNTY	108	M6 PROCESSING	506	838.7000	1
ST. LOUIS COUNTY	108	M6 PROCESSING	506	1075.2996	2
ST. LOUIS COUNTY	109	M6 PROCESSING	506	1582.2000	3
ST. LOUIS COUNTY	108	M6 PROCESSING	506	2005.0020	4
ST. LOUIS COUNTY	108	M10 TRANS/PYROLYSIS	510	37.1976	4

Table XXVIII

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
M1 TRANS	501	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	39.1000	1
M1 TRANS	501	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	50.8000	2
M1 TRANS	501	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	75.9000	3
M1 TRANS	501	TRANSFER PKR TO VAN	901	M10 TRANS/PYROLYSIS	510	98.8000	4
M7 TRANS/PYROLYSIS	507	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	1
M7 TRANS/PYROLYSIS	507	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	2
M7 TRANS/PYROLYSIS	507	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	3
M7 TRANS/PYROLYSIS	507	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	4
M9 TRANS	509	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	1
M9 TRANS	509	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	114.6000	2
M9 TRANS	509	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	195.3000	3
M9 TRANS	509	TRANSFER PKR TO VAN	901	M10 TRANS/PYROLYSIS	510	271.0000	4
M10 TRANS/PYROLYSIS	510	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	1
M10 TRANS/PYROLYSIS	510	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	2
M10 TRANS/PYROLYSIS	510	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	3
M10 TRANS/PYROLYSIS	510	TRANSFER PKR TO VAN	901	M6 PROCESSING	506	0.0	4

St. Louis G

Table XXVIII

Page 12 of 13

PROCESSING ACTIVITY LEVELS

*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	MODEL PERIOD
M1 TRANS	501	TRANSFER PKR TO VAN	901	39.1000	1
M1 TRANS	501	TRANSFER PKR TO VAN	901	50.8000	2
M1 TRANS	501	TRANSFER PKR TO VAN	901	75.9000	3
M1 TRANS	501	TRANSFER PKR TO VAN	901	98.8000	4
M6 PROCESSING	506	GAS PYROLYSIS	935	2226.8987	2
M6 PROCESSING	506	GAS PYROLYSIS	935	3447.5950	3
M6 PROCESSING	505	GAS PYROLYSIS	935	3447.5874	4
M6 PROCESSING	506	SHREDDED FUEL/SEC RC	955	2466.3992	1
M7 TRANS/PYROLYSIS	507	TRANSFER PKR TO VAN	901	0.0	1
M7 TRANS/PYROLYSIS	507	TRANSFER PKR TO VAN	901	0.0	2
M7 TRANS/PYROLYSIS	507	GAS PYROLYSIS	935	825.5989	2
M7 TRANS/PYROLYSIS	507	GAS PYROLYSIS	935	825.5989	3
M7 TRANS/PYROLYSIS	507	GAS PYROLYSIS	935	1505.6995	4
M9 TRANS	509	TRANSFER PKR TO VAN	901	0.0	1
M9 TRANS	509	TRANSFER PKR TO VAN	901	114.6000	2
M9 TRANS	509	TRANSFER PKR TO VAN	901	195.3000	3
M9 TRANS	509	TRANSFER PKR TO VAN	901	271.0000	4
M10 TRANS/PYROLYSIS	510	TRANSFER PKR TO VAN	901	0.0	1
M10 TRANS/PYROLYSIS	510	TRANSFER PKR TO VAN	901	0.0	2
M10 TRANS/PYROLYSIS	510	GAS PYROLYSIS	935	0.0	2
M10 TRANS/PYROLYSIS	510	GAS PYROLYSIS	935	0.0	3
M10 TRANS/PYROLYSIS	510	GAS PYROLYSIS	935	406.9971	4
U1 MKT/PROCESSING	514	SHREDDED FUEL/SEC RC	955	0.0	1
U1 MKT/PROCESSING	514	SHREDDED FUEL/SEC RC	955	0.0	2
U1 MKT/PROCESSING	514	SHREDDED FUEL/SEC RC	955	0.0	3
U1 MKT/PROCESSING	514	SHREDDED FUEL/SEC RC	955	0.0	4
A19 VIGUS QUARRY	711	SANITARY LANDFILL	907	0.0	1
A19 VIGUS QUARRY	711	SANITARY LANDFILL	907	0.0	2
A19 VIGUS QUARRY	711	SANITARY LANDFILL	907	0.0	3
A19 VIGUS QUARRY	711	SANITARY LANDFILL	907	0.0	4

Table XXVIII

```
                     CAPACITY BUILDING ACTIVITY LEVELS
                *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

                                                       MODEL              ACTIVITY  LINEAR
     SITE NAME          I D        PROCESS NAME    I D  PERIOD             LEVEL *  SEGMENT

M1 TRANS                501    TRANSFER PKR TO VAN  901    1               75.9000     2
M1 TRANS                501    TRANSFER PKR TO VAN  901    4               98.8000     2
M6 PROCESSING           506    GAS PYROLYSIS        935    2             2226.8987     1
M6 PROCESSING           506    GAS PYROLYSIS        935    3             1220.6963     1
M6 PROCESSING           506    SHREDDED FUEL/SEC RC 955    4                0.0        1
M6 PROCESSING           506    SHREDDED FUEL/SEC RC 955    1             2466.3992     3
M7 TRANS/PYROLYSIS      507    TRANSFER PKR TO VAN  901    1                0.0        1
M7 TRANS/PYROLYSIS      507    TRANSFER PKR TO VAN  901    4                0.0        1
M7 TRANS/PYROLYSIS      507    GAS PYROLYSIS        935    2              825.5989     1
M7 TRANS/PYROLYSIS      507    GAS PYROLYSIS        935    4              680.0994     1
M9 TRANS                509    TRANSFER PKR TO VAN  901    1                0.0        1
M9 TRANS                509    TRANSFER PKR TO VAN  901    2              271.0000     3
M10 TRANS/PYROLYSIS     510    TRANSFER PKR TO VAN  901    1                0.0        1
M10 TRANS/PYROLYSIS     510    TRANSFER PKR TO VAN  901    4                0.0        1
M10 TRANS/PYROLYSIS     510    GAS PYROLYSIS        935    2                0.0        1
M10 TRANS/PYROLYSIS     510    GAS PYROLYSIS        935    4              406.9971     1
U1 MKT/PROCESSING       514    SHREDDED FUEL/SEC RC 955    1                0.0        1
U1 MKT/PROCESSING       514    SHREDDED FUEL/SEC RC 955    4                0.0        1
A19 VIGUS QUARRY        711    SANITARY LANDFILL    907    1                0.0        1
A19 VIGUS QUARRY        711    SANITARY LANDFILL    907    3                0.0        1

                  CAPACITY UNDERUTILIZATION ACTIVITY LEVELS
                *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

                                                       MODEL              ACTIVITY
     SITE NAME          I D        PROCESS NAME    I D  PERIOD             LEVEL *

M1 TRANS                501,   TRANSFER PKR TO VAN  901    1               36.8000
M1 TRANS                501'   TRANSFER PKR TO VAN  901    2               25.1000
M6 PROCESSING           506    SHREDDED FUEL/SEC RC 955    2             2466.3992
M6 PROCESSING           506    SHREDDED FUEL/SEC RC 955    3             2466.3992
M9 TRANS                509    TRANSFER PKR TO VAN  901    2              156.4000
M9 TRANS                509    TRANSFER PKR TO VAN  901    3               75.7000


           LAND CONSTRAINT ACTIVITY LEVELS OF SLACKS IN ACRE-FEET

                  SITE         ACTIVITY LEVEL
                   711              20000.0000
```

Page 1 of 4

Table XXIX
OUTPUTS FOR N. E. MASSACHUSETTS A
(Phase 3 Solution)

OBJECTIVE VALUE IS 1071.0181 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS 1218.1 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS .879 PER TON

TRANSPORTATION ACTIVITY FOR SOURCE TO INTERMEDIATE PAIRS

Origin	Destination	Activity Level*
101	501	189.7
102	503	157.7
103	503	55.7
104	504	43.4
105	504	12.0
106	506	45.8
107	507	129.1
108	507	38.3
109	507	53.4
110	510	108.0
111	503	115.1
112	512	186.0
113	514	11.4
114	514	72.5

*Activity Levels in thousands of tons per year.

Table XXIX

TRANSPORTATION ACTIVITY DATA FOR INTERMEDIATE TO INTERMEDIATE PAIRS

Origin Site	Origin Process	Destination	Activity Level*
501	901	503	189.7
502	901	503	0
503	905	644	134.1728
503	925	644	0
504	901	503	55.4
504	905	643	0
504	905	644	0
506	901	503	45.8
506	905	643	0
507	901	503	220.8
507	905	643	0
510	901	503	108.0
512	915	634	46.5
514	901	503	83.9
514	905	643	0
514	925	643	0

*Activity Levels in thousands of tons per year.

Table XXIX

TRANSPORTATION ACTIVITY DATA FOR THE CATEGORY 5 PAIRS

Origin Site	Origin Process	Destination	Activity Level*
512	915	712	0
633	936	603	0
634	936	614	46.5
637	936	607	0
643	946	603	0
644	946	614	134.1728
647	946	607	0

*Activity Levels in thousands of tons per year.

Table XXIX
PROCESSING ACTIVITY LEVELS

Origin Site	Origin Process	Activity Level*	Linear Segment
501	901	189.7	3
502	901	0	1
503	905	1032.0989	3
504	901	55.4	1
506	901	45.8	1
507	901	220.8	3
510	901	108.0	2
512	915	186.0	1
514	901	83.9	2
607	906	0	1
614	906	180.6728	2
633	936	0	1
634	936	46.5	1
637	936	0	1
643	946	0	1
644	946	134.1728	1
647	946	0	1
704	907	0	1
705	907	0	1
706	907	0	1
708	907	0	1
709	907	0	1
710	907	0	1
711	907	0	1
713	907	0	1

*Activity Levels in thousands of tons per year.

Table XXX

Page 1 of 4

OUTPUTS FOR N. E. MASSACHUSETTS A-2
(Phase 4 Solution)

OBJECTIVE VALUE IS 1179.8943 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS 1218.1 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS .96864 PER TON

TRANSPORTATION ACTIVITY FOR SOURCE TO INTERMEDIATE PAIRS

Origin	Destination	Activity Level*
101	501	189.7
102	502	.0003
102	503	157.6997
103	503	55.7
104	504	43.4
105	504	12.0
106	506	45.8
107	507	129.1
108	507	38.3
109	507	53.4
110	510	108.0
111	503	115.1
112	512	186.0
113	514	11.4
114	514	72.5

*Activity Levels in thousands of tons per year.

Table XXX

TRANSPORTATION ACTIVITY DATA FOR INTERMEDIATE TO INTERMEDIATE PAIRS

Origin Site	Origin Process	Destination	Activity Level*
501	901	503	189.7
502	901	503	0
503	905	647	85.4749
504	901	503	55.4
504	905	647	0
506	901	507	45.8
506	905	647	0
507	901	503	0
510	901	507	108.0
512	915	634	0
512	915	637	46.5
514	901	503	83.8999
514	905	647	0

*Activity Levels in thousands of tons per year.

N. E. Mass. A-2 Table XXX Page 3 of 4

TRANSPORTATION ACTIVITY DATA FOR THE CATEGORY 5 PAIRS

Origin Site	Origin Process	Destination	Activity Level*
503	905	643	0
503	925	643	0
507	905	647	48.6980
514	905	644	0
514	925	644	0
633	936	603	0
634	936	614	0
637	936	607	46.5
643	946	603	0
644	946	614	0
647	946	607	134.1729

*Activity Levels in thousands of tons per year.

N. E. Mass. A-2 Table XXX Page 4 of 4

PROCESSING ACTIVITY LEVELS

Origin Site	Origin Process	Activity Level*	Linear Segment
501	901	189.7	3
503	905	657.499	2
504	901	55.4	1
506	901	45.8	1
507	905	374.5999	2
510	901	108.0	2
512	915	186.0	1
514	901	83.8999	2
607	906	180.6729	2
633	936	0	1
637	936	46.5	1
643	946	0	1
644	946	0	1
647	946	134.1729	1

*Activity Levels in thousands of tons per year.

Table XXXI
OUTPUTS FOR N. E. MASSACHUSETTS A-3
(Phase 3 Solution)

Page 1 of 4

OBJECTIVE VALUE IS 877.3237 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS 1218.1 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS .720239 PER TON

TRANSPORTATION ACTIVITY DATA FOR THE SOURCE TO INTERMEDIATE PAIRS

Origin	Destination	Activity Level*
101	501	189.7
102	502	157.7
103	502	55.7
104	504	43.4
105	514	12.0
106	506	45.8
107	507	129.1
108	507	38.3
109	507	53.4
110	510	108.0
111	502	115.1
112	512	186.0
113	514	11.4
114	514	72.5

*Activity Levels in thousands of tons per year.

Table XXXI

TRANSPORTATION ACTIVITY DATA FOR INTERMEDIATE TO INTERMEDIATE PAIRS

Origin Site	Origin Process	Destination	Activity Level*
501	901	514	189.7
502	901	514	328.4998
503	905	647	0
503	925	647	0
504	901	514	43.4
504	905	644	0
506	901	514	45.8
506	905	644	0
507	901	514	220.8
507	905	644	0
510	901	514	108.0
512	915	634	46.5
514	901	503	0
514	901	507	0

*Activity Levels in thousands of tons per year.

Table XXXI

TRANSPORTATION ACTIVITY DATA FOR THE CATEGORY 5 PAIRS

Origin Site	Origin Process	Destination	Activity Level*
514	905	644	134.1729
514	925	644	0
633	936	603	0
634	936	614	46.5
637	936	607	0
643	946	603	0
644	946	614	134.1729
647	946	607	0

*Activity Levels in thousands of tons per year.

Table XXXI

PROCESSING ACTIVITY LEVELS

Origin Site	Origin Process	Activity Level*	Linear Segment
501	901	189.7	3
502	901	328.4998	3
504	901	43.4	1
506	901	45.8	1
507	901	220.8	3
510	901	108.0	2
512	915	186.0	1
514	905	1032.0991	3
603	906	0	1
607	906	0	1
614	906	180.6729	2
633	936	0	1
634	936	46.5	1
637	936	0	1
643	946	0	1
644	946	134.1729	1
647	946	0	1

*Activity Levels in thousands of tons per year.

Table XXXII
Outputs for N. E. Massachusetts A-4
(Phase 3 Solution)

Page 1 of 2

```
OBJECTIVE VALUE IS     825.0811 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS    1218.0939 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS      .677351 PER TON

           TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
                       *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

                                                                          ACTIVITY
        ORIGIN NAME        NO      DESTINATION NAME        NO             LEVEL *

     SOUTH ESSEX OUTER     101     SALEM INCINERATOR/TR   501             199.7000
     LAWRENCE              102     HAVERHILL PROCESSING   503             157.7000
     HAVERHILL             103     HAVERHILL PROCESSING   503              55.7000
     NEWBURYPORT           104     NEWBURYPORT TR/PROC    504              43.4000
     E CENTRAL ESSEX       105     NEWBURYPORT TR/PROC    504              12.0000
     GLOUCESTER            106     GLOUCESTER TR/PROC     506              45.5000
     LOWELL EAST           107     LOWELL INCIN/TR/PROC   507             129.1000
     LOWELL WEST           108     LOWELL INCIN/TR/PROC   507              38.2000
     LOWELL SOUTH          109     LOWELL INCIN/TR/PROC   507              53.5000
     EAST MIDDLESEX        110     EA MIDDLESEX TRANS     510             105.0000
     NEW HAMPSHIRE         111     HAVERHILL PROCESSING   503             115.1000
     RESCO COMMUNITIES     112     RESCO PROCESSING       512             186.0000
     S W CENTRAL ESSEX     113     SO ESSEX INNER TR/PR   514              11.4000
     SOUTH ESSEX INNER     114     SO ESSEX INNER TR/PR   514              72.5000

      TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
                   *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME             ORIGIN PROCESS NAME       DESTINATION SITE NAME             ACTIVITY
                                                                                               LEVEL *

SALEM INCINERATOR/TR   501    TRANSFER STATION      901     HAVERHILL PROCESSING  503           199.7000
LAWRENCE INCIN/TRANS   502    TRANSFER STATION      901     HAVERHILL PROCESSING  503             0.0
NEWBURYPORT TR/PROC    504    TRANSFER STATION      901     HAVERHILL PROCESSING  503            55.4000
NEWBURYPORT TR/PROC    504    SHREDDED FUEL         905     HAV DUMMY HEAVY END   543             0.0
GLOUCESTER TR/PROC     506    TRANSFER STATION      901     HAVERHILL PROCESSING  503            45.5000
GLOUCESTER TR/PROC     506    SHREDDED FUEL         905     HAV DUMMY HEAVY END   543             0.0
LOWELL INCIN/TR/PROC   507    TRANSFER STATION      901     HAVERHILL PROCESSING  503           220.8000
LOWELL INCIN/TR/PROC   507    SHREDDED FUEL         905     HAV DUMMY HEAVY END   543             0.0
EA MIDDLESEX TRANS     510    TRANSFER STATION      901     HAVERHILL PROCESSING  503           105.0000
RESCO PROCESSING       512    RESCO PROCESS         915     HAV DUMMY INCIN RES   523            46.5000
SO ESSEX INNER TR/PR   514    TRANSFER STATION      901     HAVERHILL PROCESSING  503            83.9000
SO ESSEX INNER TR/PR   514    SHREDDED FUEL         905     HAV DUMMY HEAVY END   543             0.0
SO ESSEX INNER TR/PR   514    DRIED SHREDDED FUEL   925     HAV DUMMY HEAVY END   543             0.0
```

Reproduced from best available copy.

N. E. Mass. A-4 Table XXXII Page 2 of 2

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME		ORIGIN PROCESS NAME WHERE APPLICABLE		DESTINATION SITE NAME		ACTIVITY LEVEL *
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	HAV DUMMY HEAVY END	643	134.1730
HAVERHILL PROCESSING	503	DRIED SHREDDED FUEL	925	HAV DUMMY HEAVY END	643	0.0
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	HAVERHILL SCDY RECOV	603	46.5000
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	SO ESX INR SCDY RECV	614	0.0
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	LOWELL EA SCDY RECOV	607	0.0
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	HAVERHILL SCDY RECOV	603	134.1730
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	SO ESX INR SCDY RECV	614	0.0
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	LOWELL EA SCDY RECOV	607	0.0

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME		PROCESS NAME		ACTIVITY LEVEL *	LINEAR SEGMENT
SALEM INCINERATOR/TR	501	TRANSFER STATION	901	189.7000	3
LAWRENCE INCIN/TRANS	502	TRANSFER STATION	901	0.0	2
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	1032.0991	3
NEWBURYPORT TR/PROC	504	TRANSFER STATION	901	55.4000	1
GLOUCESTER TR/PROC	505	TRANSFER STATION	901	45.0000	1
LOWELL INCIN/TR/PROC	507	TRANSFER STATION	901	220.0000	3
EA MIDDLESEX TRANS	510	TRANSFER STATION	901	103.0000	2
RESCO PROCESSING	512	RESCO PROCESS	915	126.0000	1
SO ESSEX INNER TR/PR	514	TRANSFER STATION	901	83.9000	2
HAVERHILL SCDY RECOV	603	SECONDARY RECOVERY	906	180.6730	2
LOWELL EA SCDY RECOV	607	SECONDARY RECOVERY	906	0.0	1
SO ESX INR SCDY RECV	614	SECONDARY RECOVERY	906	0.0	1
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	46.5000	1
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	0.0	1
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	0.0	1
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	134.1730	1
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	0.0	1
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	0.0	1

Table XXXIII
Outputs for N.E. Massachusetts B-1
(Phase 4 Solution)

Page 1 of 2

```
OBJECTIVE VALUE IS   -1807.6484 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS    2436.1987 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS     -0.7420 PER TON


            TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
                           *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

                                                                            ACTIVITY
      ORIGIN NAME        I D      DESTINATION NAME      I D                   LEVEL *

    SOUTH ESSEX OUTER    101     SALEM INCINERATOR/TR  501                  379.3999
    LAWRENCE             102     HAVERHILL PROCESSING  503                  315.3999
    HAVERHILL            103     HAVERHILL PROCESSING  503                  111.4000
    NEWBURYPORT          104     NEWBURYPORT TR/PROC   504                   86.8000
    E CENTRAL ESSEX      105     NEWBURYPORT TR/PROC   504                   24.0000
    GLOUCESTER           106     GLOUCESTER TR/PROC    506                   91.6000
    LOWELL EAST          107     LOWELL INCIN/TR/PROC  507                  258.2000
    LOWELL WEST          108     LOWELL INCIN/TR/PROC  507                   76.6000
    LOWELL SOUTH         109     LOWELL INCIN/TR/PROC  507                  106.8000
    EAST MIDDLESEX       110     EA MIDDLESEX TRANS    510                  214.0000
    NEW HAMPSHIRE        111     HAVERHILL PROCESSING  503                  230.2000
    RESCO COMMUNITIES    112     RESCO PROCESSING      512                  372.0000
    S W CENTRAL ESSEX    113     SO ESSEX INNER TR/PR  514                   22.8000
    SOUTH ESSEX INNER    114     SO ESSEX INNER TR/PR  514                  145.0000

      TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
                          *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME      I D     ORIGIN PROCESS NAME  I D     DESTINATION SITE NAME I D             ACTIVITY
                                                                                                   LEVEL *

SALEM INCINERATOR/TR  501    TRANSFER STATION      901     HAVERHILL PROCESSING  503             379.3999
LAWRENCE INCIN/TRANS  502    TRANSFER STATION      901     HAVERHILL PROCESSING  503               0.0
NEWBURYPORT TR/PROC   504    TRANSFER STATION      901     HAVERHILL PROCESSING  503             110.8000
NEWBURYPORT TR/PROC   504    SHREDDED FUEL         905     HAV DUMMY HEAVY END   643               0.0
GLOUCESTER TR/PROC    506    TRANSFER STATION      901     HAVERHILL PROCESSING  503              91.6000
GLOUCESTER TR/PROC    506    SHREDDED FUEL         905     HAV DUMMY HEAVY END   643               0.0
LOWELL INCIN/TR/PROC  507    TRANSFER STATION      901     HAVERHILL PROCESSING  503             441.5996
LOWELL INCIN/TR/PROC  507    SHREDDED FUEL         905     HAV DUMMY HEAVY END   643               0.0
EA MIDDLESEX TRANS    510    TRANSFER STATION      901     HAVERHILL PROCESSING  503             216.0000
RESCO PROCESSING      512    RESCO PROCESS         915     HAV DUMMY INCIN RES   633              93.0000
SO ESSEX INNER TR/PR  514    TRANSFER STATION      901     HAVERHILL PROCESSING  503             167.8000
SO ESSEX INNER TR/PR  514    SHREDDED FUEL         905     HAV DUMMY HEAVY END   643               0.0
SO ESSEX INNER TR/PR  514    DRIED SHREDDED FUEL   925     HAV DUMMY HEAVY END   643               0.0
```

Table XXXIII

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)

*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	HAV DUMMY HEAVY END	643	268.3457
HAVERHILL PROCESSING	503	DRIED SHREDDED FUEL	925	HAV DUMMY HEAVY END	643	0.0
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	HAVERHILL SCDY RECOV	603	93.0000
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	SO ESX INR SCDY RECV	614	0.0
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	LOWELL EA SCDY RECOV	607	0.0
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	HAVERHILL SCDY RECOV	603	268.3457
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	SO ESX INR SCDY RECV	614	0.0
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	LOWELL EA SCDY RECOV	607	0.0

PROCESSING ACTIVITY LEVELS

*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
SALEM INCINERATOR/TR	501	TRANSFER STATION	901	379.3999	3
LAWRENCE INCIN/TRANS	502	TRANSFER STATION	901	0.0	2
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	2064.1987	3
NEWBURYPORT TR/PROC	504	TRANSFER STATION	901	110.8000	2
GLOUCESTER TR/PROC	506	TRANSFER STATION	901	91.6000	2
LOWELL INCIN/TR/PROC	507	TRANSFER STATION	901	441.5996	3
EA MIDDLESEX TRANS	510	TRANSFER STATION	901	216.0000	3
RESCO PROCESSING	512	RESCO PROCESS	915	372.0000	2
SO ESSEX INNER TR/PR	514	TRANSFER STATION	901	167.8000	3
HAVERHILL SCDY RECOV	603	SECONDARY RECOVERY	906	361.3455	2
LOWELL EA SCDY RECOV	607	SECONDARY RECOVERY	906	0.0	1
SO ESX INR SCDY RECV	614	SECONDARY RECOVERY	906	0.0	1
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	93.0000	1
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	0.0	1
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	0.0	1
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	268.3457	1
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	0.0	1
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	0.0	1

Table XXXIV
Outputs for N.E. Massachusetts B-2
(Phase 4 Solution)

Page 1 of 2

```
OBJECTIVE VALUE IS    1448.4475 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS     609.3996 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS      2.3768 PER TON

              TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
                          *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

                                                                          ACTIVITY
            ORIGIN NAME        I D      DESTINATION NAME      I D            LEVEL *

           SOUTH ESSEX OUTER   101     SALEM INCINERATOR/TR  501           94.9000
           LAWRENCE            102     HAVERHILL PROCESSING  503           78.9000
           HAVERHILL           103     HAVERHILL PROCESSING  503           27.9000
           NEWBURYPORT         104     NEWBURYPORT TR/PROC   504           21.7000
           E CENTRAL ESSEX     105     NEWBURYPORT TR/PROC   504            6.0000
           GLOUCESTER          106     GLOUCESTER TR/PROC    506           22.9000
           LOWELL EAST         107     LOWELL INCIN/TR/PROC  507           64.6000
           LOWELL WEST         108     LOWELL INCIN/TR/PROC  507           19.2000
           LOWELL SOUTH        109     LOWELL INCIN/TR/PROC  507           26.7000
           EAST MIDDLESEX      110     EA MIDDLESEX TRANS    510           54.0000
           NEW HAMPSHIRE       111     HAVERHILL PROCESSING  503           57.6000
           RESCO COMMUNITIES   112     RESCO PROCESSING      512           93.0000
           S W CENTRAL ESSEX   113     SO ESSEX INNER TR/PR  514            5.7000
           SOUTH ESSEX INNER   114     SO ESSEX INNER TR/PR  514           36.3000
                                                 .
        TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
                         *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

  ORIGIN SITE NAME      I D    ORIGIN PROCESS NAME  I D    DESTINATION SITE NAME I D              ACTIVITY
                                                                                                   LEVEL *

  SALEM INCINERATOR/TR  501   TRANSFER STATION      901   HAVERHILL PROCESSING  503              94.9000
  LAWRENCE INCIN/TRANS  502   TRANSFER STATION      901   HAVERHILL PROCESSING  503               0.0
  HAVERHILL PROCESSING  503   SHREDDED FUEL         905   LWLDUMMY HEAVY END    647              67.1319
  NEWBURYPORT TR/PROC   504   TRANSFER STATION      901   HAVERHILL PROCESSING  503              27.7000
  NEWBURYPORT TR/PROC   504   SHREDDED FUEL         905   HAV DUMMY HEAVY END   643               0.0
  GLOUCESTER TR/PROC    506   TRANSFER STATION      901   HAVERHILL PROCESSING  503              22.9000
  GLOUCESTER TR/PROC    506   SHREDDED FUEL         905   HAV DUMMY HEAVY END   643               0.0
  LOWELL INCIN/TR/PROC  507   TRANSFER STATION      901   HAVERHILL PROCESSING  503             110.5000
  LOWELL INCIN/TR/PROC  507   SHREDDED FUEL         905   HAV DUMMY HEAVY END   643               0.0
  EA MIDDLESEX TRANS    510   TRANSFER STATION      901   HAVERHILL PROCESSING  503              54.0000
  RESCO PROCESSING      512   RESCO PROCESS         915   HAV DUMMY INCIN RES   633               0.0
  RESCO PROCESSING      512   RESCO PROCESS         915   LWL DUMMY INCIN RES   637              23.2500
  SO ESSEX INNER TR/PR  514   TRANSFER STATION      901   HAVERHILL PROCESSING  503              42.0000
  SO ESSEX INNER TR/PR  514   SHREDDED FUEL         905   HAV DUMMY HEAVY END   643               0.0
  SO ESSEX INNER TR/PR  514   DRIED SHREDDED FUEL   925   HAV DUMMY HEAVY END   643               0.0
```

Table XXXIV

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	HAV DUMMY HEAVY END	643	0.0
HAVERHILL PROCESSING	503	DRIED SHREDDED FUEL	925	HAV DUMMY HEAVY END	643	0.0
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	HAVERHILL SCDY RECOV	603	0.0
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	SO ESX INR SCDY RECV	614	0.0
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	LOWELL EA SCDY RECOV	607	23.2500
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	HAVERHILL SCDY RECOV	603	0.0
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	SO ESX INR SCDY RECV	614	0.0
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	LOWELL EA SCDY RECOV	607	67.1319

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
SALEM INCINERATOR/TR	501	TRANSFER STATION	901	94.9000	2
LAWRENCE INCIN/TRANS	502	TRANSFER STATION	901	0.0	2
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	516.3992	2
NEWBURYPORT TR/PROC	504	TRANSFER STATION	901	27.7000	1
GLOUCESTER TR/PROC	506	TRANSFER STATION	901	22.9000	1
LOWELL INCIN/TR/PROC	507	TRANSFER STATION	901	110.5000	2
EA MIDDLESEX TRANS	510	TRANSFER STATION	901	54.0000	2
RESCO PROCESSING	512	RESCO PROCESS	915	93.0000	1
SO ESSEX INNER TR/PR	514	TRANSFER STATION	901	42.0000	2
LOWELL EA SCDY RECOV	607	SECONDARY RECOVERY	906	90.3819	1
SO ESX INR SCDY RECV	614	SECONDARY RECOVERY	906	0.0	1
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	0.0	1
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	0.0	1
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	23.2500	1
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	0.0	1
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	67.1319	1

Table XXXV
Outputs for N. E. Massachusetts C-1
(Phase 4 Solution)

Page 1 of 2

```
OBJECTIVE VALUE IS   -1606.1833 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCK!

TOTAL TONNAGE IS    1218.0989 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS     -1.5485 PER TON

                TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
                         *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

          ORIGIN NAME         I D       DESTINATION NAME        I D               ACTIVITY
                                                                                   LEVEL *

        SOUTH ESSEX OUTER     101      SALEM INCINERATOR/TR    501               189.7000
        LAWRENCE              102      HAVERHILL PROCESSING    503               157.7000
        HAVERHILL             103      HAVERHILL PROCESSING    503                55.7000
        NEWBURYPORT           104      HAVERHILL PROCESSING    503                43.4000
        E CENTRAL ESSEX       105      HAVERHILL PROCESSING    503                12.0000
        GLOUCESTER            106      GLOUCESTER TR/PROC      506                45.8000
        LOWELL EAST           107      LOWELL INCIN/TR/PROC    507               129.1000
        LOWELL WEST           108      LOWELL INCIN/TR/PROC    507                39.3000
        LOWELL SOUTH          109      LOWELL INCIN/TR/PROC    507                53.4000
        EAST MIDDLESEX        110      EA MIDDLESEX TRANS      510               108.0000
        NEW HAMPSHIRE         111      HAVERHILL PROCESSING    503               115.1000
        RESCO COMMUNITIES     112      RESCO PROCESSING        512               186.0000
        S W CENTRAL ESSEX     113      HAVERHILL PROCESSING    503                11.4000
        SOUTH ESSEX INNER     114      SO ESSEX INNER TR/PR    514                72.5000

          TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
                         *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

   ORIGIN SITE NAME      I D    ORIGIN PROCESS NAME  I D    DESTINATION SITE NAME I D            ACTIVITY
                                                                                                  LEVEL *

   SALEM INCINERATOR/TR  501    TRANSFER STATION     901    HAVERHILL PROCESSING  503            189.7000
   LAWRENCE INCIN/TRANS  502    TRANSFER STATION     901    HAVERHILL PROCESSING  503              0.0
   HAVERHILL PROCESSING  503    SHREDDED FUEL        905    LWLDUMMY HEAVY END    647            134.1730
   NEWBURYPORT TR/PROC   504    TRANSFER STATION     901    HAVERHILL PROCESSING  503              0.0
   NEWBURYPORT TR/PROC   504    SHREDDED FUEL        905    HAV DUMMY HEAVY END   643              0.0
   GLOUCESTER TR/PROC    506    TRANSFER STATION     901    HAVERHILL PROCESSING  503             45.8000
   GLOUCESTER TR/PROC    506    SHREDDED FUEL        905    HAV DUMMY HEAVY END   643              0.0
   LOWELL INCIN/TR/PROC  507    TRANSFER STATION     901    HAVERHILL PROCESSING  503            220.8000
   LOWELL INCIN/TR/PROC  507    SHREDDED FUEL        905    HAV DUMMY HEAVY END   643              0.0
   EA MIDDLESEX TRANS    510    TRANSFER STATION     901    HAVERHILL PROCESSING  503            108.0000
   RESCO PROCESSING      512    RESCO PROCESS        915    HAV DUMMY INCIN RES   633              0.0
   RESCO PROCESSING      512    RESCO PROCESS        915    LWL DUMMY INCIN RES   637             46.5000
   SO ESSEX INNER TR/PR  514    TRANSFER STATION     901    HAVERHILL PROCESSING  503             72.5000
   SO ESSEX INNER TR/PR  514    SHREDDED FUEL        905    HAV DUMMY HEAVY END   643              0.0
   SO ESSEX INNER TR/PR  514    DRIED SHREDDED FUEL  925    HAV DUMMY HEAVY END   643              0.0
```

Table XXXV

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE,	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	HAV DUMMY HEAVY END	643	0.0
HAVERHILL PROCESSING	503	DRIED SHREDDED FUEL	925	HAV DUMMY HEAVY END	643	0.0
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	HAVERHILL SCDY RECOV	603	0.0
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	935	SO ESX INR SCDY RECV	614	0.0
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	LOWELL EA SCDY RECOV	607	46.5000
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	HAVERHILL SCDY RECOV	603	0.0
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	SO ESX INR SCDY RECV	614	0.0
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	LOWELL EA SCDY RECOV	607	134.1730

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
SALEM INCINERATOR/TR	501	TRANSFER STATION	901	189.7000	3
LAWRENCE INCIN/TRANS	502	TRANSFER STATION	901	0.0	2
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	1032.0491	3
NEWBURYPORT TR/PROC	504	TRANSFER STATION	901	0.0	1
GLOUCESTER TR/PROC	506	TRANSFER STATION	901	45.8000	1
LOWELL INCIN/TR/PROC	507	TRANSFER STATION	901	220.9000	3
EA MIDDLESEX TRANS	510	TRANSFER STATION	901	103.0000	2
RESCO PROCESSING	512	RESCO PROCESS	915	186.0000	1
SO ESSEX INNER TR/PR	514	TRANSFER STATION	901	72.5000	2
LOWELL EA SCDY RECOV	607	SECONDARY RECOVERY	906	180.0730	2
SO ESX INR SCDY RECV	614	SECONDARY RECOVERY	906	0.0	1
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	935	0.0	1
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	0.0	1
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	46.5000	1
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	0.0	1
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	134.1730	1

Table XXXVI
Outputs for N. E. Massachusetts C-2
(Phase 4 Solution)

Page 1 of 2

```
OBJECTIVE VALUE IS     289.6099 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS    1218.0989 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS      0.2378 PER TON

                 TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
                                 *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

            ORIGIN NAME        I D      DESTINATION NAME      I D             ACTIVITY
                                                                                LEVEL *
          SOUTH ESSEX OUTER    101     SALEM INCINERATOR/TR  501             189.7000
          LAWRENCE             102     HAVERHILL PROCESSING  503             157.7000
          HAVERHILL            103     HAVERHILL PROCESSING  503              55.7000
          NEWBURYPORT          104     NEWBURYPORT TR/PROC   504              43.4000
          E CENTRAL ESSEX      105     HAVERHILL PROCESSING  503              12.0000
          GLOUCESTER           106     GLOUCESTER TR/PROC    506              45.8000
          LOWELL EAST          107     LOWELL INCIN/TR/PROC  507             129.1000
          LOWELL WEST          108     LOWELL INCIN/TR/PROC  507              38.3000
          LOWELL SOUTH         109     EA MIDDLESEX TRANS    510              53.4000
          EAST MIDDLESEX       110     EA MIDDLESEX TRANS    510             108.0000
          NEW HAMPSHIRE        111     HAVERHILL PROCESSING  503             115.1000
          RESCO COMMUNITIES    112     RESCO PROCESSING      512             186.0000
          S W CENTRAL ESSEX    113     SO ESSEX INNER TR/PR  514              11.4000
          SOUTH ESSEX INNER    114     SO ESSEX INNER TR/PR  514              72.5000
       TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TU INTERMEDIATE FACILITY PAIR(S)
                           *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR
ORIGIN SITE NAME      I D    ORIGIN PROCESS NAME  I D    DESTINATION SITE NAME I D          ACTIVITY
                                                                                              LEVEL *
SALEM INCINERATOR/TR  501    TRANSFER STATION     901    HAVERHILL PROCESSING  503          189.7000
LAWRENCE INCIN/TRANS  502    TRANSFER STATION     901    HAVERHILL PROCESSING  503            0.0
NEWBURYPORT TR/PROC   504    TRANSFER STATION     901    HAVERHILL PROCESSING  503           43.4000
NEWBURYPORT TR/PROC   504    SHREDDED FUEL        905    HAV DUMMY HEAVY END   643            0.0
GLOUCESTER TR/PROC    506    TRANSFER STATION     901    HAVERHILL PROCESSING  503           45.8000
GLOUCESTER TR/PROC    506    SHREDDED FUEL        905    HAV DUMMY HEAVY END   643            0.0
LOWELL INCIN/TR/PROC  507    TRANSFER STATION     901    HAVERHILL PROCESSING  503          167.4000
LOWELL INCIN/TR/PROC  507    SHREDDED FUEL        905    HAV DUMMY HEAVY END   643            0.0
EA MIDDLESEX TRANS    510    TRANSFER STATION     901    HAVERHILL PROCESSING  503          161.4000
RESCO PROCESSING      512    RESCO PROCESS        915    HAV DUMMY INCIN RES   633           46.5000
SO ESSEX INNER TR/PR  514    TRANSFER STATION     901    HAVERHILL PROCESSING  503           83.9000
SO ESSEX INNER TR/PR  514    SHREDDED FUEL        905    HAV DUMMY HEAVY END   643            0.0
SO ESSEX INNER TR/PR  514    DRIED SHREDDED FUEL  925    HAV DUMMY HEAVY END   643            0.0
```

Table XXXVI

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE,	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	HAV DUMMY HEAVY END	643	134.1730
HAVERHILL PROCESSING	503	DRIED SHREDDED FUEL	925	HAV DUMMY HEAVY END	643	0.0
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	HAVERHILL SCDY RECOV	603	46.5000
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	SO ESX INR SCDY RECV	614	0.0
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	LOWELL EA SCDY RECOV	607	0.0
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	HAVERHILL SCDY RECOV	603	134.1730
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	SO ESX INR SCDY RECV	614	0.0
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	LOWELL EA SCDY RECOV	607	0.0

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
SALEM INCINERATOR/TR	501	TRANSFER STATION	901	189.7000	3
LAWRENCE INCIN/TRANS	502	TRANSFER STATION	901	0.0	2
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	1032.0991	3
NEWBURYPORT TR/PROC	504	TRANSFER STATION	901	43.4000	1
GLOUCESTER TR/PROC	506	TRANSFER STATION	901	45.8000	1
LOWELL INCIN/TR/PROC	507	TRANSFER STATION	901	167.4000	3
EA MIDDLESEX TRANS	510	TRANSFER STATION	901	161.4000	3
RESCO PROCESSING	512	RESCO PROCESS	915	186.0000	1
SO ESSEX INNER TR/PR	514	TRANSFER STATION	901	83.9000	2
HAVERHILL SCDY RECOV	603	SECONDARY RECOVERY	906	180.6730	2
LOWELL EA SCDY RECOV	607	SECONDARY RECOVERY	906	0.0	1
SO ESX INR SCDY RECV	614	SECONDARY RECOVERY	906	0.0	1
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	46.5000	1
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	0.0	1
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	0.0	1
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	134.1730	1
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	0.0	1
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	0.0	1

Table XXXVII
Outputs for N. E. Massachusetts C-3
(Phase 4 Solution)

Page 1 of 2

```
OBJECTIVE VALUE IS    3419.1289 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS    1218.0989 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS      2.8069 PER TON

                 TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
                               *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

                                                                             ACTIVITY
           ORIGIN NAME         I D      DESTINATION NAME        I D            LEVEL *

          SOUTH ESSEX OUTER    101     SALEM INCINERATOR/TR    901           189.7000
          LAWRENCE             102     LAWRENCE INCIN/TRANS    502           157.7000
          HAVERHILL            103     HAVERHILL PROCESSING    503            55.7000
          NEWBURYPORT          104     NEWBURYPORT TR/PROC     504            43.4000
          E CENTRAL ESSEX      105     SO ESSEX INNER TR/PR    514            12.0000
          GLOUCESTER           106     GLOUCESTER TR/PROC      506            45.8000
          LOWELL EAST          107     LOWELL INCIN/TR/PROC    507           129.1000
          LOWELL WEST          108     LOWELL INCIN/TR/PROC    507            38.3000
          LOWELL SOUTH         109     LOWELL INCIN/TR/PROC    507            53.4000
          EAST MIDDLESEX       110     EA MIDDLESEX TRANS      510           108.0000
          NEW HAMPSHIRE        111     HAVERHILL PROCESSING    503           115.1000
          RESCO COMMUNITIES    112     RESCO PROCESSING        512           186.0000
          S W CENTRAL ESSEX    113     SO ESSEX INNER TR/PR    514            11.4000
          SOUTH ESSEX INNER    114     SO ESSEX INNER TR/PR    514            72.5000

       TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
                           *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME       I D    ORIGIN PROCESS NAME  I D    DESTINATION SITE NAME I D              ACTIVITY
                                                                                                  LEVEL *

SALEM INCINERATOR/TR  501    TRANSFER STATION      901    SO ESSEX INNER TR/PR  514             189.7000
LAWRENCE INCIN/TRANS  502    TRANSFER STATION      901    HAVERHILL PROCESSING  503             157.7000
NEWBURYPORT TR/PROC   504    TRANSFER STATION      901    HAVERHILL PROCESSING  503              43.4000
NEWBURYPORT TR/PROC   504    SHREDDED FUEL         905    HAV DUMMY HEAVY END   643               0.0
GLOUCESTER TR/PROC    506    TRANSFER STATION      901    SO ESSEX INNER TR/PR  514              45.8000
GLOUCESTER TR/PROC    506    SHREDDED FUEL         905    HAV DUMMY HEAVY END   643               0.0
LOWELL INCIN/TR/PROC  507    TRANSFER STATION      901    HAVERHILL PROCESSING  503               0.0
LOWELL INCIN/TR/PROC  507    SHREDDED FUEL         905    HAV DUMMY HEAVY END   643              28.7040
EA MIDDLESEX TRANS    510    TRANSFER STATION      901    SO ESSEX INNER TR/PR  514             108.0000
RESCO PROCESSING      512    RESCO PROCESS         915    HAV DUMMY INCIN RES   633              46.5000
SO ESSEX INNER TR/PR  514    TRANSFER STATION      901    HAVERHILL PROCESSING  503               0.0
SO ESSEX INNER TR/PR  514    SHREDDED FUEL         905    HAV DUMMY HEAVY END   643              57.1220
SO ESSEX INNER TR/PR  514    DRIED SHREDDED FUEL   925    HAV DUMMY HEAVY END   643               0.0
```

Table XXXVII

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	HAV DUMMY HEAVY END	643	48.3470
HAVERHILL PROCESSING	503	DRIED SHREDDED FUEL	925	HAV DUMMY HEAVY END	643	0.0
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	HAVERHILL SCDY RECOV	603	46.5000
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	SO ESX INR SCDY RECV	614	0.0
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	LOWELL EA SCDY RECOV	607	0.0
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	HAVERHILL SCDY RECOV	603	134.1730
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	SO ESX INR SCDY RECV	614	0.0
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	LOWELL EA SCDY RECOV	607	0.0

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
SALEM INCINERATOR/TR	501	TRANSFER STATION	901	189.7000	3
LAWRENCE INCIN/TRANS	502	TRANSFER STATION	901	157.7000	3
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	371.8989	2
NEWBURYPORT TR/PROC	504	TRANSFER STATION	901	43.4000	1
GLOUCESTER TR/PROC	506	TRANSFER STATION	901	45.8000	1
LOWELL INCIN/TR/PROC	507	SHREDDED FUEL	905	220.8000	2
EA MIDDLESEX TRANS	510	TRANSFER STATION	901	108.0000	2
RESCO PROCESSING	512	RESCO PROCESS	915	186.0000	1
SO ESSEX INNER TR/PR	514	SHREDDED FUEL	905	439.3994	2
HAVERHILL SCDY RECOV	603	SECONDARY RECOVERY	906	180.6730	2
LOWELL EA SCDY RECOV	607	SECONDARY RECOVERY	906	0.0	1
SO ESX INR SCDY RECV	614	SECONDARY RECOVERY	906	0.0	1
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	46.5000	1
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	0.0	1
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	0.0	1
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	134.1730	1
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	0.0	1
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	0.0	1

Table XXXVIII
Outputs for N. E. Massachusetts D-1
(Phase 3 Solution)

Page 1 of 2

```
OBJECTIVE VALUE IS      910.2827 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS    1210.0989 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS      0.7473 PER TON

            TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
                      *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

                                                                    ACTIVITY
     ORIGIN NAME        I D      DESTINATION NAME      I D           LEVEL *

   SOUTH ESSEX OUTER    101     SALEM INCINERATOR/TR  501          189.7000
   LAWRENCE             102     LAWRENCE INCIN/TRANS  502          157.7000
   HAVERHILL            103     HAVERHILL PROCESSING  503           55.7000
   NEWBURYPORT          104     NEWBURYPORT TR/PROC   504           43.4000
   E CENTRAL ESSEX      105     NEWBURYPORT TR/PROC   504           12.0000
   GLOUCESTER           106     GLOUCESTER TR/PROC    506           45.8000
   LOWELL EAST          107     LOWELL INCIN/TR/PROC  507          129.1000
   LOWELL WEST          108     LOWELL INCIN/TR/PROC  507           38.3000
   LOWELL SOUTH         109     LOWELL INCIN/TR/PROC  507           53.4000
   EAST MIDDLESEX       110     EA MIDDLESEX TRANS    510          108.0000
   NEW HAMPSHIRE        111     HAVERHILL PROCESSING  503          119.1000
   RESCO COMMUNITIES    112     RESCO PROCESSING      512          136.0000
   S W CENTRAL ESSEX    113     SO ESSEX INNER TR/PR  514           11.4000
   SOUTH ESSEX INNER    114     SO ESSEX INNER TR/PR  514           72.5000

       TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
                      *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME       I D    ORIGIN PROCESS NAME  I D    DESTINATION SITE NAME I D              ACTIVITY
                                                                                                   LEVEL *

SALEM INCINERATOR/TR  501    TRANSFER STATION     901    HAVERHILL PROCESSING  503             189.7000
LAWRENCE INCIN/TRANS  502    TRANSFER STATION     901    HAVERHILL PROCESSING  503             157.6999
NEWBURYPORT TR/PROC   504    TRANSFER STATION     901    HAVERHILL PROCESSING  503              55.4000
NEWBURYPORT TR/PROC   504    SHREDDED FUEL        905    HAV DUMMY HEAVY END   643               0.0
GLOUCESTER TR/PROC    506    TRANSFER STATION     901    HAVERHILL PROCESSING  503              45.8000
GLOUCESTER TR/PROC    506    SHREDDED FUEL        905    HAV DUMMY HEAVY END   643               0.0
LOWELL INCIN/TR/PROC  507    TRANSFER STATION     901    HAVERHILL PROCESSING  503             220.7999
LOWELL INCIN/TR/PROC  507    SHREDDED FUEL        905    HAV DUMMY HEAVY END   643               0.0
EA MIDDLESEX TRANS    510    TRANSFER STATION     901    HAVERHILL PROCESSING  503             108.0000
RESCO PROCESSING      512    RESCO PROCESS        915    HAV DUMMY INCIN RES   633              46.5600
SO ESSEX INNER TR/PR  514    TRANSFER STATION     901    HAVERHILL PROCESSING  503              83.9000
SO ESSEX INNER TR/PR  514    SHREDDED FUEL        905    HAV DUMMY HEAVY END   643               0.0
```

Table XXXVIII

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	HAV DUMMY HEAVY END	643	134.1729
HAVERHILL PROCESSING	503	DRIED SHREDDED FUEL	925	HAV DUMMY HEAVY END	643	0.0
LOWELL INCIN/TR/PROC	507	SHREDDED FUEL	905	LWLDUMMY HEAVY END	647	0.0
SO ESSEX INNER TR/PR	514	SHREDDED FUEL	905	SO EX DUM HEAVY END	644	0.0
SO ESSEX INNER TR/PR	514	DRIED SHREDDED FUEL	925	SO EX DUM HEAVY END	644	0.0
HAV DUMMY INCIN RES	632	DUMMY INCIN RESIDUE	936	HAVERHILL SCDY RECOV	603	46.5000
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	SO ESX INR SCDY RECV	614	0.0
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	LOWELL EA SCDY RECOV	607	0.0
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	HAVERHILL SCDY RECOV	603	134.1729
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	SO ESX INR SCDY RECV	614	0.0
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	LOWELL EA SCDY RECOV	607	0.0

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
SALEM INCINERATOR/TR	501	TRANSFER STATION	901	189.7000	3
LAWRENCE INCIN/TRANS	502	TRANSFER STATION	901	157.6989	3
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	1032.0994	3
NEWBURYPORT TR/PROC	504	TRANSFER STATION	901	55.4000	1
GLOUCESTER TR/PROC	506	TRANSFER STATION	901	45.8000	1
LOWELL INCIN/TR/PROC	507	TRANSFER STATION	901	220.7999	3
EA MIDDLESEX TRANS	510	TRANSFER STATION	901	108.0000	2
RESCO PROCESSING	512	RESCO PROCESS	915	186.0000	1
SO ESSEX INNER TR/PR	514	TRANSFER STATION	901	83.9000	2
HAVERHILL SCDY RECOV	603	SECONDARY RECOVERY	906	180.6729	2
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	46.5000	1
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	0.0	1
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	0.0	1
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	134.1729	1
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	0.0	1
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	0.0	1

Table XXXIX
Outputs for N. E. Massachusetts D-2
(Phase 3 Solution)

```
OBJECTIVE VALUE IS    3299.3506 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS    1218.0989 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS      2.7086 PER TON

              TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
                          *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

                                                                       ACTIVITY
          ORIGIN NAME        I D     DESTINATION NAME      I D          LEVEL *

       SOUTH ESSEX OUTER     101     SALEM INCINERATOR/TR  501         189.7000
       LAWRENCE              102     LAWRENCE INCIN/TRANS  502         157.7000
       HAVERHILL             103     HAVERHILL PROCESSING  503          55.7000
       NEWBURYPORT           104     NEWBURYPORT TR/PROC   504          43.4000
       E CENTRAL ESSEX       105     GLOUCESTER TR/PROC    506          12.0000
       GLOUCESTER            106     GLOUCESTER TR/PROC    506          45.8000
       LOWELL EAST           107     LAWRENCE INCIN/TRANS  502         129.1000
       LOWELL WEST           108     HAVERHILL PROCESSING  503           3.7967
       LOWELL WEST           108     LOWELL INCIN/TR/PROC  507          34.5032
       LOWELL SOUTH          109     HAVERHILL PROCESSING  503          93.4000
       EAST MIDDLESEX        110     LAWRENCE INCIN/TRANS  502         109.0000
       NEW HAMPSHIRE         111     LAWRENCE INCIN/TRANS  502         115.1000
       RESCO COMMUNITIES     112     RESCO PROCESSING      512         185.0000
       S W CENTRAL ESSEX     113     SO ESSEX INNER TR/PR  514          11.4000
       SOUTH ESSEX INNER     114     SO ESSEX INNER TR/PR  514          72.5000

     TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
                  *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME       I D    ORIGIN PROCESS NAME  I D    DESTINATION SITE NAME I D           ACTIVITY
                                                                                               LEVEL *
SALEM INCINERATOR/TR  501    TRANSFER STATION      901    SO ESSEX INNER TR/PR  514           189.7000
LAWRENCE INCIN/TRANS  502    TRANSFER STATION      901    LOWELL INCIN/TR/PROC  507           461.1235
LAWRENCE INCIN/TRANS  502    TRANSFER STATION      901    SO ESSEX INNER TR/PR  514            46.7755
NEWBURYPORT TR/PROC   504    TRANSFER STATION      901    SO ESSEX INNER TR/PR  514            43.3999
NEWBURYPORT TR/PROC   504    SHREDDED FUEL         905    HAV DUMMY HEAVY END   643             0.0
GLOUCESTER TR/PROC    506    TRANSFER STATION      901    SO ESSEX INNER TR/PR  514            57.7999
GLOUCESTER TR/PROC    506    SHREDDED FUEL         905    HAV DUMMY HEAVY END   643             0.0
LOWELL INCIN/TR/PROC  507    TRANSFER STATION      901    HAVERHILL PROCESSING  503             0.0
EA MIDDLESEX TRANS    510    TRANSFER STATION      901    HAVERHILL PROCESSING  503             0.0
RESCO PROCESSING      512    RESCO PROCESS         915    HAV DUMMY INCIN RES   633             0.0
RESCO PROCESSING      512    RESCO PROCESS         915    LWL DUMMY INCIN RES   637            46.5000
SO ESSEX INNER TR/PR  514    TRANSFER STATION      901    HAVERHILL PROCESSING  503             0.0
SO ESSEX INNER TR/PR  514    SHREDDED FUEL         905    LWLDUMMY HEAVY END    647            55.0647
```

Table XXXIX

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	HAV DUMMY HEAVY END	643	0.0
HAVERHILL PROCESSING	503	DRIED SHREDDED FUEL	925	HAV DUMMY HEAVY END	643	0.0
LOWELL INCIN/TR/PROC	507	SHREDDED FUEL	905	LWLDUMMY HEAVY END	647	64.4315
SO ESSEX INNER TR/PR	514	SHREDDED FUEL	905	SO EX DUM HEAVY END	644	0.0
SO ESSEX INNER TR/PR	514	DRIED SHREDDED FUEL	925	SO EX DUM HEAVY END	644	0.0
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	HAVERHILL SCDY RECOV	603	0.0
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	SO ESX INR SCDY RECV	614	0.0
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	LOWELL EA SCDY RECOV	607	46.5000
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	HAVERHILL SCDY RECOV	603	0.0
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	SO ESX INR SCDY RECV	614	0.0
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	LOWELL EA SCDY RECOV	607	119.4962

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
SALEM INCINERATOR/TR	501	TRANSFER STATION	901	199.7000	3
LAWRENCE INCIN/TRANS	502	TRANSFER STATION	901	509.8994	3
HAVERHILL PROCESSING	503	GAS PYROLYSIS	935	112.8965	2
NEWBURYPORT TR/PROC	504	TRANSFER STATION	901	43.4000	1
GLOUCESTER TR/PROC	506	TRANSFER STATION	901	57.7999	1
LOWELL INCIN/TR/PROC	507	SHREDDED FUEL	905	495.6265	2
EA MIDDLESEX TRANS	510	TRANSFER STATION	901	0.0	2
RESCO PROCESSING	512	RESCO PROCESS	915	186.0000	1
SO ESSEX INNER TR/PR	514	SHREDDED FUEL	905	423.5737	2
LOWELL EA SCDY RECOV	607	SECONDARY RECOVERY	906	165.9962	2
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	0.0	1
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	0.0	1
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	46.5000	1
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	0.0	1
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	0.0	1
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	119.4962	1

Table XL
Outputs for N. E. Massachusetts E-1
(Phase 4 Solution)

Page 1 of 2

```
OBJECTIVE VALUE IS    1802.0232 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS    1218.0989 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS      1.4794 PER TON

          TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
                         *ACTIVITY [illegible] ARE IN THOUSANDS OF TONS PER YEAR

     ORIGIN NAME          I D      DEST[illegible]ME           I D              ACTIVITY
                                                                                 LEVEL *
   SOUTH ESSEX OUTER      101      SALEM [illegible]ATOR/TR    501
   LAWRENCE               102      HAVERHILL PROCESSING        503              189.7000
   HAVERHILL              103      HAVERHILL PROCESSING        503              157.7000
   NEWBURYPORT            104      NEWBURYPORT TR/PROC         504               55.7000
   E CENTRAL ESSEX        105      NEWBURYPORT TR/PROC         504               63.4000
   GLOUCESTER             106      GLOUCESTER TR/PROC          506               12.0000
   LOWELL EAST            107      LOWELL INCIN/TR/PROC        507               45.9000
   LOWELL WEST            108      LOWELL INCIN/TR/PROC        507              129.1000
   LOWELL SOUTH           109      LOWELL INCIN/TR/PROC        507               39.3000
   EAST MIDDLESEX         110      EA MIDDLESEX TRANS          510               53.4000
   NEW HAMPSHIRE          111      HAVERHILL PROCESSING        503              108.0000
   RESCO COMMUNITIES      112      RESCO PROCESSING            512              115.1000
   S W CENTRAL ESSEX      113      SO ESSEX INNER TR/PR        514              196.0000
   SOUTH ESSEX INNER      114      SO ESSEX INNER TR/PR        514               11.4000
                                                                                 72.5000
     TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
                      *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME       I D    ORIGIN PROCESS NAME  I D   DESTINATION SITE NAME I D

                                                                                    ACTIVITY
                                                                                     LEVEL *
SALEM INCINERATOR/TR   501    TRANSFER STATION     901   HAVERHILL PROCESSING  503
LAWRENCE INCIN/TRANS   502    TRANSFER STATION     901   HAVERHILL PROCESSING  503  189.7000
NEWBURYPORT TR/PROC    504    TRANSFER STATION     901   HAVERHILL PROCESSING  503    0.0
NEWBURYPORT TR/PROC    504    SHREDDED FUEL        905   HAV DUMMY HEAVY END   643   55.4000
GLOUCESTER TR/PROC     506    TRANSFER STATION     901   HAVERHILL PROCESSING  503    0.0
GLOUCESTER TR/PROC     506    SHREDDED FUEL        905   HAV DUMMY HEAVY END   643   45.8000
LOWELL INCIN/TR/PROC   507    TRANSFER STATION     901   HAVERHILL PROCESSING  503    0.0
LOWELL INCIN/TR/PROC   507    SHREDDED FUEL        905   HAV DUMMY HEAVY END   643  240.8000
EA MIDDLESEX TRANS     510    TRANSFER STATION     901   HAVERHILL PROCESSING  503    0.0
RESCO PROCESSING       512    RESCO PROCESS        915   HAV DUMMY INCIN RES   633  108.0000
SO ESSEX INNER TR/PR   514    TRANSFER STATION     901   HAVERHILL PROCESSING  503   46.5000
SO ESSEX INNER TR/PR   514    SHREDDED FUEL        905   HAV DUMMY HEAVY END   643   83.9000
SO ESSEX INNER TR/PR   514    DRIED SHREDDED FUEL  925   HAV DUMMY HEAVY END   643    0.0
                                                                                      0.0
```

Table XL

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	HAV DUMMY HEAVY END	643	134.1730
HAVERHILL PROCESSING	503	DRIED SHREDDED FUEL	925	HAV DUMMY HEAVY END	643	0.0
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	HAVERHILL SCDY RECOV	603	46.5000
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	SO ESX INR SCDY RECV	614	0.0
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	LOWELL EA SCDY RECOV	607	0.0
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	HAVERHILL SCDY RECOV	603	134.1730
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	SO ESX INR SCDY RECV	614	0.0
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	LOWELL EA SCDY RECOV	607	0.0

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
SALEM INCINERATOR/TR	501	TRANSFER STATION	901	189.7000	3
LAWRENCE INCIN/TRANS	502	TRANSFER STATION	901	0.0	2
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	1032.0991	2
NEWBURYPORT TR/PROC	504	TRANSFER STATION	901	55.4000	1
GLOUCESTER TR/PROC	506	TRANSFER STATION	901	45.8000	1
LOWELL INCIN/TR/PROC	507	TRANSFER STATION	901	220.8000	3
EA MIDDLESEX TRANS	510	TRANSFER STATION	901	108.0000	2
RESCO PROCESSING	512	RESCO PROCESS	915	186.0000	2
SO ESSEX INNER TR/PR	514	TRANSFER STATION	901	83.9000	2
HAVERHILL SCDY RECOV	603	SECONDARY RECOVERY	906	180.6730	1
LOWELL EA SCDY RECOV	607	SECONDARY RECOVERY	906	0.0	1
SO ESX INR SCDY RECV	614	SECONDARY RECOVERY	906	0.0	1
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	46.5000	1
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	0.0	1
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	0.0	1
HAV DUMMY HEAVY END	643	DUMMY HEAVY EN	946	134.1730	1
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	0.0	1
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	0.0	1

Table XLI
Outputs for N. E. Massachusetts E-2
(Phase 4 Solution)

Page 1 of 2

```
OBJECTIVE VALUE IS    -622.7158 IN THOUSANDS OF DOLLARS PER YEAR INCLUDING ALL COSTS FROM LOADING OF PACKER TRUCKS

TOTAL TONNAGE IS    1218.0989 IN THOUSANDS OF TONS PER YEAR

AVERAGE SYSTEM COST IS     -0.5112 PER TON

                    TRANSPORTATION ACTIVITY LEVEL DATA FOR THE SOURCE TO INTERMEDIATE FACILITY PAIR(S)
                                    *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

                                                                                     ACTIVITY
              ORIGIN NAME          I D      DESTINATION NAME        I D              LEVEL *

            SOUTH ESSEX OUTER      101     SALEM INCINERATOR/TR    501              189.7000
            LAWRENCE               102     HAVERHILL PROCESSING    503              157.7000
            HAVERHILL              103     HAVERHILL PROCESSING    503               55.7000
            NEWBURYPORT            104     NEWBURYPORT TR/PROC     504               43.4000
            E CENTRAL ESSEX        105     NEWBURYPORT TR/PROC     504               12.0000
            GLOUCESTER             106     GLOUCESTER TR/PROC      506               45.8000
            LOWELL EAST            107     LOWELL INCIN/TR/PROC    507              129.1000
            LOWELL WEST            108     LOWELL INCIN/TR/PROC    507               38.3000
            LOWELL SOUTH           109     LOWELL INCIN/TR/PROC    507               53.4000
            EAST MIDDLESEX         110     EA MIDDLESEX TRANS      510              108.0000
            NEW HAMPSHIRE          111     HAVERHILL PROCESSING    503              115.1000
            RESCO COMMUNITIES      112     RESCO PROCESSING        512              186.0000
            S W CENTRAL ESSEX      113     SO ESSEX INNER TR/PR    514               11.4000
            SOUTH ESSEX INNER      114     SO ESSEX INNER TR/PR    514               72.5000

          TRANSPORTATION ACTIVITY LEVEL DATA FOR THE INTERMEDIATE TO INTERMEDIATE FACILITY PAIR(S)
                             *ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

   ORIGIN SITE NAME       I D     ORIGIN PROCESS NAME  I D     DESTINATION SITE NAME I D          ACTIVITY
                                                                                                   LEVEL *

   SALEM INCINERATOR/TR   501     TRANSFER STATION      901     HAVERHILL PROCESSING  503          189.7000
   LAWRENCE INCIN/TRANS   502     TRANSFER STATION      901     HAVERHILL PROCESSING  503            0.0
   NEWBURYPORT TR/PROC    504     TRANSFER STATION      901     HAVERHILL PROCESSING  503           55.4000
   NEWBURYPORT TR/PROC    504     SHREDDED FUEL         905     HAV DUMMY HEAVY END   643            0.0
   GLOUCESTER TR/PROC     506     TRANSFER STATION      901     HAVERHILL PROCESSING  503           45.8000
   GLOUCESTER TR/PROC     506     SHREDDED FUEL         905     HAV DUMMY HEAVY END   643            0.0
   LOWELL INCIN/TR/PROC   507     TRANSFER STATION      901     HAVERHILL PROCESSING  503          220.8000
   LOWELL INCIN/TR/PROC   507     SHREDDED FUEL         905     HAV DUMMY HEAVY END   643            0.0
   EA MIDDLESEX TRANS     510     TRANSFER STATION      901     HAVERHILL PROCESSING  503          108.0000
   RESCO PROCESSING       512     RESCO PROCESS         915     HAV DUMMY INCIN RES   633           46.5000
   SO ESSEX INNER TR/PR   514     TRANSFER STATION      901     HAVERHILL PROCESSING  503           83.9000
   SO ESSEX INNER TR/PR   514     SHREDDED FUEL         905     HAV DUMMY HEAVY END   643            0.0
   SO ESSEX INNER TR/PR   514     DRIED SHREDDED FUEL   925     HAV DUMMY HEAVY END   643            0.0
```

Table XLI

TRANSPORTATION ACTIVITY LEVEL DATA FOR THE CATEGORY FIVE PAIR(S)
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

ORIGIN SITE NAME	I D	ORIGIN PROCESS NAME WHERE APPLICABLE	I D	DESTINATION SITE NAME	I D	ACTIVITY LEVEL *
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	HAV DUMMY HEAVY END	643	134.1730
HAVERHILL PROCESSING	503	DRIED SHREDDED FUEL	925	HAV DUMMY HEAVY END	643	0.0
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	HAVERHILL SCDY RECOV	603	46.5000
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	SO ESX INR SCDY RECV	614	0.0
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	LOWELL EA SCDY RECOV	607	0.0
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	HAVERHILL SCDY RECOV	603	134.1730
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	SO ESX INR SCDY RECV	614	0.0
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	LOWELL EA SCDY RECOV	607	0.0

PROCESSING ACTIVITY LEVELS
*ACTIVITY LEVELS ARE IN THOUSANDS OF TONS PER YEAR

SITE NAME	I D	PROCESS NAME	I D	ACTIVITY LEVEL *	LINEAR SEGMENT
SALEM INCINERATOR/TR	501	TRANSFER STATION	901	189.7000	3
LAWRENCE INCIN/TRANS	502	TRANSFER STATION	901	0.0	2
HAVERHILL PROCESSING	503	SHREDDED FUEL	905	1032.0991	3
NEWBURYPORT TR/PROC	504	TRANSFER STATION	901	55.4000	1
GLOUCESTER TR/PROC	506	TRANSFER STATION	901	45.8000	1
LOWELL INCIN/TR/PROC	507	TRANSFER STATION	901	220.8000	3
EA MIDDLESEX TRANS	510	TRANSFER STATION	901	108.0000	2
RESCO PROCESSING	512	RESCO PROCESS	915	186.0000	2
SO ESSEX INNER TR/PR	514	TRANSFER STATION	901	83.9000	2
HAVERHILL SCDY RECOV	603	SECONDARY RECOVERY	906	180.6730	2
LOWELL EA SCDY RECOV	607	SECONDARY RECOVERY	906	0.0	1
SO ESX INR SCDY RECV	614	SECONDARY RECOVERY	906	0.0	1
HAV DUMMY INCIN RES	633	DUMMY INCIN RESIDUE	936	46.5000	1
SO EX DUMMY INCIN RS	634	DUMMY INCIN RESIDUE	936	0.0	1
LWL DUMMY INCIN RES	637	DUMMY INCIN RESIDUE	936	0.0	1
HAV DUMMY HEAVY END	643	DUMMY HEAVY END	946	134.1730	1
SO EX DUM HEAVY END	644	DUMMY HEAVY END	946	0.0	1
LWLDUMMY HEAVY END	647	DUMMY HEAVY END	946	0.0	1

Table XLII   Page 1 of 5

CROW-FLY Mode 2 Test (Front-End Only)

(Category 5 activities were provided; all others were generated)

```
   TRANSPORTATION FILE    260 ENTRIES

        CODE  ORIGIN   PROCESS  SITE DEST.   TIME   DISTANCE  SPEED

TRANS    1     101      101       705       15.00    11.30    45.0
TRANS    1     101      101       706       15.60    11.70    45.0
TRANS    1     101      101       710       15.10    11.30    45.0
TRANS    1     101      101       712        5.10     3.80    45.0
TRANS    1     101      101       713        9.50     7.10    45.0
TRANS    1     102      102       704       16.70    12.50    45.0
TRANS    1     102      102       705       17.20    12.90    45.0
TRANS    1     102      102       708       15.60    11.70    45.0
TRANS    1     102      102       709       14.60    10.90    45.0
TRANS    1     102      102       710       10.00     7.50    45.0
TRANS    1     102      102       711        9.90     7.40    45.0
TRANS    1     102      102       713       12.70     9.50    45.0
TRANS    1     103      103       704        8.80     6.60    45.0
TRANS    1     103      103       705       13.70    10.30    45.0
TRANS    1     103      103       710       16.50    12.40    45.0
TRANS    1     103      103       711       11.70     8.80    45.0
TRANS    1     103      103       713       14.50    10.80    45.0
TRANS    1     104      104       704        2.20     1.70    45.0
TRANS    1     104      104       705       11.10     8.30    45.0
TRANS    1     104      104       706       19.90    14.90    45.0
TRANS    1     104      104       713       16.10    13.40    45.0
TRANS    1     105      105       704       12.10     9.10    45.0
TRANS    1     105      105       705        1.20     0.90    45.0
TRANS    1     105      105       706       10.60     7.90    45.0
TRANS    1     105      105       710       19.70    14.70    45.0
TRANS    1     105      105       713       10.80     8.10    45.0
TRANS    1     106      106       705       15.40    11.50    45.0
TRANS    1     106      106       706        4.90     3.70    45.0
TRANS    1     107      107       708        5.20     3.90    45.0
TRANS    1     107      107       709        7.70     5.70    45.0
TRANS    1     107      107       710       10.90     8.20    45.0
TRANS    1     107      107       711       13.70    10.30    45.0
TRANS    1     107      107       713       19.30    14.50    45.0
TRANS    1     108      108       708        0.0      0.0     45.0
TRANS    1     108      108       709        9.80     7.30    45.0
TRANS    1     108      108       710       15.50    11.60    45.0
TRANS    1     108      108       711       16.40    12.30    45.0
TRANS    1     109      109       708        9.90     7.30    45.0
TRANS    1     109      109       709        0.0      0.0     45.0
TRANS    1     109      109       710        8.20     6.10    45.0
TRANS    1     109      109       712       19.70    14.80    45.0
TRANS    1     109      109       713       17.70    13.30    45.0
TRANS    1     110      110       705       18.50    13.90    45.0
TRANS    1     110      110       708       15.50    11.60    45.0
TRANS    1     110      110       709        8.20     6.10    45.0
TRANS    1     110      110       710        0.0      0.0     45.0
TRANS    1     110      110       711       19.10    14.30    45.0
TRANS    1     110      110       712       14.70    11.00    45.0
TRANS    1     110      110       713        9.50     7.20    45.0
TRANS    1     111      111       708       18.90    14.20    45.0
```

```
         TRANSPORTATION FILE    266 ENTRIES

      CODE  ORIGIN   PROCESS   SITE DEST.   TIME   DISTANCE   SPEED

TRANS   1    111       111       711        5.00      3.90     45.0
TRANS   1    112       112       705       19.70     14.80     45.0
TRANS   1    112       112       709       19.70     14.80     45.0
TRANS   1    112       112       710       14.70     11.00     45.0
TRANS   1    112       112       712        0.0       0.0      45.0
TRANS   1    112       112       713       12.50      9.30     45.0
TRANS   1    113       113       704       15.70     11.30     45.0
TRANS   1    113       113       705        5.20      3.90     45.0
TRANS   1    113       113       706       13.20      9.90     45.0
TRANS   1    113       113       710       13.70     10.30     45.0
TRANS   1    113       113       712       15.10     11.30     45.0
TRANS   1    113       113       713        4.40      3.30     45.0
TRANS   1    114       114       705       12.40      9.30     45.0
TRANS   1    114       114       706       16.70     12.50     45.0
TRANS   1    114       114       709       18.00     13.50     45.0
TRANS   1    114       114       710       10.50      7.90     45.0
TRANS   1    114       114       712        9.00      6.00     45.0
TRANS   1    114       114       713        4.50      3.40     45.0
TRANS   2    101       101       501        0.0       0.0      45.0
TRANS   2    101       101       506       15.60     11.70     45.0
TRANS   2    101       101       510       15.10     11.30     45.0
TRANS   2    101       101       512        5.10      3.90     45.0
TRANS   2    101       101       514        5.90      4.40     45.0
TRANS   2    102       102       502        1.90      1.50     45.0
TRANS   2    102       102       503        5.50      4.10     45.0
TRANS   2    102       102       504       17.90     13.40     45.0
TRANS   2    102       102       507       12.80      9.60     45.0
TRANS   2    102       102       510       10.00      7.50     45.0
TRANS   2    102       102       514       16.00     12.00     45.0
TRANS   2    103       103       502        6.20      4.70     45.0
TRANS   2    103       103       503        3.00      2.20     45.0
TRANS   2    103       103       504       10.30      7.70     45.0
TRANS   2    103       103       510       16.60     12.40     45.0
TRANS   2    103       103       514       18.20     13.60     45.0
TRANS   2    104       104       502       15.90     11.90     45.0
TRANS   2    104       104       503       13.20      9.90     45.0
TRANS   2    104       104       504        0.0       0.0      45.0
TRANS   2    104       104       506       19.90     14.90     45.0
TRANS   2    105       105       501       16.00     12.00     45.0
TRANS   2    105       105       502       16.40     12.30     45.0
TRANS   2    105       105       503       16.20     12.20     45.0
TRANS   2    105       105       504       10.50      7.90     45.0
TRANS   2    105       105       506       10.60      7.90     45.0
TRANS   2    105       105       510       19.70     14.70     45.0
TRANS   2    105       105       514       12.60      9.40     45.0
TRANS   2    106       106       501       19.80     14.80     45.0
TRANS   2    106       106       506        4.90      3.70     45.0
TRANS   2    107       107       502       12.60      9.50     45.0
TRANS   2    107       107       503       15.70     11.80     45.0
TRANS   2    107       107       507        2.20      1.70     45.0
```

CROW-FLY 2 Test   Table XLII   Page 3 of 5

```
   TRANSPORTATION FILE   260 ENTRIES

         CODE  ORIGIN    PROCESS   SITE DEST.    TIME   DISTANCE   SPEED

 TRANS    2     107        107        510       10.90      8.20     45.0
 TRANS    2     108        108        502       17.50     13.20     45.0
 TRANS    2     108        108        507        2.90      2.20     45.0
 TRANS    2     108        108        510       15.50     11.60     45.0
 TRANS    2     109        109        502       16.30     12.20     45.0
 TRANS    2     109        109        507        8.20      6.20     45.0
 TRANS    2     109        109        510        8.20      6.10     45.0
 TRANS    2     109        109        512       19.70     14.80     45.0
 TRANS    2     109        109        514       18.40     13.80     45.0
 TRANS    2     110        110        501       15.10     11.30     45.0
 TRANS    2     110        110        502       11.00      8.20     45.0
 TRANS    2     110        110        503       14.90     11.20     45.0
 TRANS    2     110        110        507       12.80      9.60     45.0
 TRANS    2     110        110        510        0.0       0.0      45.0
 TRANS    2     110        110        512       14.70     11.00     45.0
 TRANS    2     110        110        514       10.70      8.00     45.0
 TRANS    2     111        111        502       15.30     11.50     45.0
 TRANS    2     111        111        503       13.70     10.30     45.0
 TRANS    2     111        111        507       17.90     13.40     45.0
 TRANS    2     112        112        501        5.10      3.80     45.0
 TRANS    2     112        112        510       14.70     11.00     45.0
 TRANS    2     112        112        512        0.0       0.0      45.0
 TRANS    2     112        112        514        8.90      6.70     45.0
 TRANS    2     113        113        501       11.00      8.20     45.0
 TRANS    2     113        113        502       13.40     10.10     45.0
 TRANS    2     113        113        503       14.90     11.20     45.0
 TRANS    2     113        113        504       14.90     11.20     45.0
 TRANS    2     113        113        505       13.20      9.90     45.0
 TRANS    2     113        113        510       13.70     10.30     45.0
 TRANS    2     113        113        512       15.10     11.30     45.0
 TRANS    2     113        113        514        6.40      4.80     45.0
 TRANS    2     114        114        501        5.30      3.90     45.0
 TRANS    2     114        114        502       16.10     12.10     45.0
 TRANS    2     114        114        503       19.00     14.20     45.0
 TRANS    2     114        114        506       16.70     12.50     45.0
 TRANS    2     114        114        510       10.50      7.90     45.0
 TRANS    2     114        114        512        8.00      6.00     45.0
 TRANS    2     114        114        514        1.00      0.70     45.0
 TRANS    3     501        901        506       15.60     11.70     45.0
 TRANS    3     501        901        512        5.10      3.80     45.0
 TRANS    3     501        901        514        5.80      4.40     45.0
 TRANS    3     502        901        503        4.00      3.00     45.0
 TRANS    3     502        901        504       15.90     11.90     45.0
 TRANS    3     502        901        507       14.80     11.10     45.0
 TRANS    3     502        901        514       15.60     11.70     45.0
 TRANS    3     503        905        644       18.30     13.70     45.0
 TRANS    3     503        905        647       17.70     13.30     45.0
 TRANS    3     503        925        644       18.30     13.70     45.0
 TRANS    3     503        925        647       17.70     13.30     45.0
 TRANS    3     504        901        503       13.20      9.90     45.0
```

Table XLII

```
         T R A N S P O R T A T I O N   F I L E   260  E N T R I E S
              CODE  ORIGIN   PROCESS   SITE DEST.   TIME   DISTANCE   SPEED
      TRANS    3     504       901        504        0.0      0.0      45.0
      TRANS    3     504       901        506       19.90    14.90     45.0
      TRANS    3     504       905        643       13.20     9.90     45.0
      TRANS    3     506       901        504       19.90    14.90     45.0
      TRANS    3     506       901        506        0.0      0.0      45.0
      TRANS    3     506       901        514       16.10    12.10     45.0
      TRANS    3     506       905        644       16.10    12.10     45.0
      TRANS    3     507       901        503       17.70    13.30     45.0
      TRANS    3     507       901        507        0.0      0.0      45.0
      TRANS    3     507       905        643       17.70    13.30     45.0
      TRANS    3     510       901        503       14.90    11.20     45.0
      TRANS    3     510       901        507       12.80     9.60     45.0
      TRANS    3     510       901        512       14.70    11.00     45.0
      TRANS    3     510       901        514       10.70     8.00     45.0
      TRANS    3     510       915        536        8.90     6.70     45.0
      TRANS    3     514       901        503       18.30    13.70     45.0
      TRANS    3     514       901        506       16.10    12.10     45.0
      TRANS    3     514       901        512        8.90     6.70     45.0
      TRANS    3     514       901        514        0.0      0.0      45.0
      TRANS    3     514       905        643       18.30    13.70     45.0
      TRANS    3     514       925        643       18.30    13.70     45.0
      TRANS    3     643       936        507       17.70    13.30     45.0
      TRANS    3     643       926        514       18.30    13.70     45.0
      TRANS    3     644       936        503       18.30    13.70     45.0
      TRANS    3     647       936        503       17.70    13.30     45.0
      TRANS    3     643       945        507       17.70    13.30     45.0
      TRANS    3     643       945        514       18.30    13.70     45.0
      TRANS    3     644       946        503       18.30    13.70     45.0
      TRANS    3     647       945        503       17.70    13.30     45.0
      TRANS    4     501       901        705       15.60    11.30     45.0
      TRANS    4     501       901        706       15.60    11.70     45.0
      TRANS    4     501       901        710       15.10    11.30     45.0
      TRANS    4     501       901        712        5.10     3.80     45.0
      TRANS    4     501       901        713        9.50     7.10     45.0
      TRANS    4     502       901        704       14.80    11.10     45.0
      TRANS    4     502       901        705       15.60    11.70     45.0
      TRANS    4     502       901        708       17.50    13.20     45.0
      TRANS    4     502       901        709       15.30    12.20     45.0
      TRANS    4     502       901        710       11.00     8.20     45.0
      TRANS    4     502       901        711       10.40     7.80     45.0
      TRANS    4     502       901        713       12.10     9.10     45.0
      TRANS    4     503       905        704       11.80     8.90     45.0
      TRANS    4     503       905        705       15.70    11.80     45.0
      TRANS    4     503       905        710       14.90    11.20     45.0
      TRANS    4     503       905        711        9.20     6.90     45.0
      TRANS    4     503       905        713       14.60    11.00     45.0
      TRANS    4     503       925        704       11.80     8.90     45.0
      TRANS    4     503       925        705       15.70    11.80     45.0
      TRANS    4     503       925        710       14.90    11.20     45.0
      TRANS    4     503       925        711        9.20     6.90     45.0
```

TRANSPORTATION FILE 260 ENTRIES

	CODE	ORIGIN	PROCESS	SITE DEST.	TIME	DISTANCE	SPEED
TRANS	4	503	925	713	14.60	11.00	45.0
TRANS	4	504	901	704	2.20	1.70	45.0
TRANS	4	504	901	705	11.10	8.30	45.0
TRANS	4	504	901	706	19.90	14.90	45.0
TRANS	4	504	901	713	18.10	13.60	45.0
TRANS	4	504	905	704	2.20	1.70	45.0
TRANS	4	504	905	705	11.10	8.30	45.0
TRANS	4	504	905	706	19.90	14.90	45.0
TRANS	4	504	905	713	18.10	13.60	45.0
TRANS	4	505	901	705	10.90	8.20	45.0
TRANS	4	505	901	706	0.0	0.0	45.0
TRANS	4	505	901	713	16.70	12.60	45.0
TRANS	4	505	905	705	10.90	8.20	45.0
TRANS	4	505	905	706	0.0	0.0	45.0
TRANS	4	505	905	713	16.70	12.60	45.0
TRANS	4	507	901	708	2.90	2.20	45.0
TRANS	4	507	901	709	8.20	6.20	45.0
TRANS	4	507	901	710	12.80	9.60	45.0
TRANS	4	507	901	711	14.80	11.10	45.0
TRANS	4	507	905	708	2.90	2.20	45.0
TRANS	4	507	905	709	8.20	6.20	45.0
TRANS	4	507	905	710	12.80	9.60	45.0
TRANS	4	507	905	711	14.80	11.10	45.0
TRANS	4	510	901	705	18.50	13.90	45.0
TRANS	4	510	901	708	15.50	11.60	45.0
TRANS	4	510	901	709	8.20	6.10	45.0
TRANS	4	510	901	710	0.0	0.0	45.0
TRANS	4	510	901	711	19.10	14.30	45.0
TRANS	4	510	901	712	14.70	11.00	45.0
TRANS	4	510	901	713	9.50	7.20	45.0
TRANS	4	514	901	705	11.40	8.60	45.0
TRANS	4	514	901	706	16.10	12.10	45.0
TRANS	4	514	901	709	18.40	13.80	45.0
TRANS	4	514	901	710	10.70	8.00	45.0
TRANS	4	514	901	712	8.90	6.70	45.0
TRANS	4	514	901	713	3.70	2.80	45.0
TRANS	4	514	905	705	11.40	8.60	45.0
TRANS	4	514	905	706	16.10	12.10	45.0
TRANS	4	514	905	709	18.40	13.80	45.0
TRANS	4	514	905	710	10.70	8.00	45.0
TRANS	4	514	905	712	8.90	6.70	45.0
TRANS	4	514	905	713	3.70	2.80	45.0
TRANS	4	514	925	705	11.40	8.60	45.0
TRANS	4	514	925	706	16.10	12.10	45.0
TRANS	4	514	925	709	18.40	13.80	45.0
TRANS	4	514	925	710	10.70	8.00	45.0
TRANS	4	514	925	712	8.90	6.70	45.0
TRANS	4	514	925	713	3.70	2.80	45.0
TRANS	5	503	905	643	-0.10	0.0	0.0
TRANS	5	503	925	643	-0.10	0.0	0.0
TRANS	5	537	905	647	-0.10	0.0	0.0
TRANS	5	512	925	712	-0.10	0.0	0.0
TRANS	5	514	905	644	-0.10	0.0	0.0
TRANS	5	514	925	644	-0.10	0.0	0.0
TRANS	5	633	936	603	-0.10	0.0	0.0
TRANS	5	576	936	614	-0.10	0.0	0.0
TRANS	5	537	935	607	-0.10	0.0	0.0
TRANS	5	643	945	603	-0.10	0.0	0.0
TRANS	5	644	946	614	-0.10	0.0	0.0
TRANS	5	647	945	607	-0.10	0.0	0.0

Reproduced from best available copy.

μσ1693
SW-164c